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Romance of the Rayon Industry

THE fascinating account given by Mr. A. B. Shearer to the London Section of the Society of Chemical Industry opens interesting thoughts. Mr. Shearer stated that the credit for the invention of artificial silk was, and frequently is, claimed for Count Chardonnet, but that it has really been derived from an invention of an Englishman, Sir Joseph Swan, F.R.S., who in 1883 patented a new method of making fibres by squirting nitrocellulose dissolved in acetic acid through a small orifice into a coagulating liquid, generally methylated spirit. The purpose of Swan's experiments was to manufacture carbon filaments for electric lamps. As so often happens with processes devised by Englishmen, the Swan patent was not used commercially, but the next year Chardonnet started commercial manufacture in a small way. Even so long after as 1891 Chardonnet was only making some 30,000 lb. of artificial silk per year. Meanwhile, in 1892 Cross, Bevan and Beadle discovered the cellulose xanthate reaction and the way was opened to the development of a new great industry. From what small beginnings, practically from chance, do great events spring! Swan was interested only in electric light. Cross might never have done his historical work but for chance. Professor H. E. Armstrong wrote in "The Times" in his obituary notice of Cross: " I remember with satisfaction being concerned in obtaining for him, against no little opposition, a grant of £100 from the Royal Society's Government grant fund, to aid him in his work on cellulose. . . . In 1892 he discovered viscose . . . the three cheap materials, caustic soda, carbon bisulphide, and wood-cellulose could be used in making a viscous material, easily reconvertible into cellulose, for which obviously many uses were to be foreseen."

The yearly output of Chardonnet's factory in 1891 has already been stated as 30,000 lb.; by the year 1900 the world output was 2,000,000 lb.; by 1910 it had reached 18,000,000 lb., and in the interval Courtaulds had started large-scale production. Within the next three years the total advanced to 25,000,000 lb., and after the war, in 1920, it had reached 55,000,000 lb. Thereafter progress became breathlessly rapid—in 1925, the world total stood at 200,000,000 lb.; in 1930 it had reached no less than 470,000,000 lb.; and last year the 1,000,000,000 lb. mark was passed. In 1935 the amount of rayon produced was equal to one-third of the total wool products of the world, and more than 10 times that of the natural silk production. England alone produced in that year 20 per cent. more rayon than Egypt, after a century of intensive cultivation and the expenditure of untold millions of money, produced in the way of cotton. To this it must be added that in 1925 the price of rayon was 12s. 6d. a pound, and in 1935 it had dropped to 2s. 6d., a decrease not due to any spectacular discovery, but to the increased scale of the operations coupled with a general advance in all-round efficiency.

It is interesting to reflect upon the complete change in the mentality of the white races which has followed this discovery of the art of making a silk substitute. It is, in its way, comparable with the whole industrial revolution of the 19th century. Silk still holds its own, and, according to Mr. Shearer, we are probably using more real silk to-day than at any time in the history of the country. Artificial silk—somehow the name " rayon " does not seem to come readily—has not displaced the older material, but it has put at the disposal of people in general, poor as well as rich, a new and striking method of adornment of the human, and particularly of the feminine, limb. The poets delight to sing of beauty unadorned, but that is as nothing as compared with the well-turned leg, garnished with chemically-produced cellulose fibre, " to show the form it seemed to hide."

The manufacturers of this material show no sign of resting on their oars. Mr. Shearer was able to show that advances are constantly being made. The brilliant, almost metallic appearance of the early rayon has given place to a more pleasing dull lustre which was obtained by the chemist before the trade would have it and which is due to admixture with oil emulsion, pigment or TiO_2. Dope-dyed yarns are coming. Within the past 30 years the strength of the fibre has more than doubled and a new Austrian process has just been introduced which can increase the strength to four times that obtaining in those days. Filaments may now be made one-third the diameter of natural silk. The process is being shortened, as, for example, by direct washing of the cakes, with consequent increase in manufacturing costs. Hollow yarns can now be made by a most ingenious process in which a canal is formed within a yarn having an overall diameter of only 0.0005 inch; this process involves generating evenly distributed gases within the viscose before extrusion. This is the record of a great industry which has not appreciably affected the prosperity of older textile industries because it has enabled a quicker turnover of clothes and so has contributed, not only work, but gaiety, colour and fascination to this drab old work-a-day world. We could do with many more such industries.

Notes and Comments

Safety in Industry

FEW, if any, industries in this country are more vitally concerned with the prevention of works accidents than the chemical industry, and it will be welcome news to those who make this aspect of industrial welfare their main concern to learn that thirteen works under the control of Imperial Chemical Industries, Ltd., have worked a total of 12,180,446 man-hours without the occurence of a lost-time accident. Representatives of the chemical industry figured prominently in a week-end conference of safety workers at Oxford last month at which there were full and frank discussions on such varied problems as electrical hazards, goggles, masks and protective devices for the head; the place of the foreman in the safety organisation; the safety officers' check list, and access to plant. Amongst the prominent men of the industry in attendance were Mr. R. E. Tugman, I.C.I. (Alkali), Ltd.; Mr. P. K. Standring, British Dyestuffs Corporation; Mr. A. J. Mallard and Mr. J. Hill, I.C.I. (General Chemicals), Ltd.; Dr. W. H. Garrett, Monsanto Chemicals, Ltd.; and Mr. J. Davidson Pratt, general manager and secretary of the Association of British Chemical Manufacturers. The conference, an official verbatim report of which is to be issued by the National Safety First Association illustrated the growing regard in industrial circles for safety work, and the fact that nearly 200 people devoted a week-end to an intensive study of the subject showed that the cause of safety does not lack willing workers. The fact that the Association has forged a link of friendship and co-operation among workers in the safety cause is not the least significant feature of its work. Incidentally, it is of interest to note that there were forty representatives of Imperial Chemical Industries at the conference. Some smaller firms had a much higher percentage of representatives.

Help for Pure Science

PURE science is probably more vital to the chemical industry than to any other single sphere of industrial activity. It is therefore of special concern to our readers that the Cavendish Laboratory, Cambridge, is to benefit to the extent of £250,000 as a result of Sir Herbert Austin's munificent recognition of the value of research to modern industry. The laboratory is regarded as the outstanding scientific research institute in Britain. Its chief founder was James Clerk Maxwell, who was appointed director in 1871. The laboratory was opened three years later. Maxwell died in 1879 and was succeeded by Lord Rayleigh. He resigned in 1884 in favour of Professor J. J. Thomson, who retired in 1919. Lord Rutherford, the present director, then succeeded, and under his direction the laboratory has won pre-eminence in experimental physics. The donation will provide an opportunity of building a modern research laboratory and will be of value in helping to defray the large expenditure required on modern research in physics which often involve the use of apparatus on a costly scale. The first use of the money will be to build a laboratory for the utilisation of very high voltages in order to carry out experiments on the transmutation of matter by high-speed particles and by radiation. Sir Herbert Austin has shown wisdom as well as generosity in selecting fundamental researches for his gift, and has set an example to other leaders of industry in thus recognising that industry must continually feed the reservoir of discovery if it is to avoid stagnation in its own sphere.

More Oil from Coal

PROVIDED there is no undue delay in the delivery of the various plant and machinery, the new plant for turning 6,000,000 tons of coal annually into smokeless and the concession of the agreement with the Bolsover Colliery, Derbyshire, will be completed in readiness for next winter's trade. The new works will be administered by the Derbyshire Coalite Co., Ltd., a subsidiary of Low Temperature Carbonisation, Ltd., and the completion of the agreement with the Bolsover Colliery Co., Ltd., marks an important step forward in the policy of converting coal into petrol, oil, and smokeless fuel. The new works will consist of 288 retorts and the necessary subsidiary machinery. The capacity of the by-product oil and petrol recovery plant will, however, be sufficient to deal with the output from 432 retorts, and the agreement for the supply of 6,000,000 tons of coal annually may be considerably increased at a later date. In a circular announcing this important new development the directors state that a contract has been entered into with Imperial Chemical Industries, Ltd., for several million gallons of coal oil suitable for the hydrogenation plant at Billingham, and large quantities have already been despatched from the company's existing works and converted into motor spirit.

Doctors of Industry

FIFTEEN years have passed since the National Institute of Industrial Psychology was founded to bring psychology to bear upon the human problems of industry. The investigational work of the Institute has led to economy of time and effort, reduced production costs and saved waste of material, while the workers have found that the investigations have improved their working conditions and eliminated much strain, fatigue, boredom and irritation. The efficiency of machines and modern methods of organisation, whether in the factory or the office, depends fundamentally upon the efficiency of the men and women who use them, which in turn depends upon their physical environment, individual suitability for their particular work and their contentment with working conditions. By studying working methods, factory layout, control of production and systems of training, the industrial psychologist can suggest changes which improve conditions and increase the efficiency and contentment of occupational life. Dislike of a supervisor, jealousy of a neighbour, fear of dismissal, suspicion that the management is handicapping the worker's efforts are things that beget poor morale and serious loss of efficiency, which in their turn burden with a dead loss the employer and industry and the nation itself. It is to solve and rectify such problems that the investigators of the National Institute of Industrial Psychology are sent out wherever their services are required.

The Utilisation of Soya Beans

A Series of Papers read before the American Chemical Society

SEVEN of the papers read at the recent meeting of the Division of Agricultural and Food Chemistry, of the American Chemical Society, at Kansas City, dealt with the utilisation of soya beans.

Chemical studies of soya beans according to a paper by N. F. Tree, reveal that their protein has a high nutritive value (practically equivalent to that of milk) due to the presence of significant quantities of essential amino acids; that the oil contains unsaturated fatty acids which are of value due to the percentages of linoleic and linolenic acid; and that it yields an alkaline ash. Besides their valuable mineral content, soya beans contain significant quantities of vitamins B and G.

A survey of the utilisation of soya beans in food products shows their many uses in bakery products. Soya bean products also are used extensively in the meat packing industry. Especially important is the use of soya beans in infant diet materials as the sole source of protein for those children who are allergic or hypersensitive to animal protein. In addition normal infants are successfully fed with soya milk and soya preparations. Moreover, the use of soya beans in nonallergic diets is not confined to infants. Of equal importance, soya beans are finding wider and wider applications in the dietary of the diabetic, as the chemical composition of this vegetable makes it peculiarly adapted to this type of diet. Other food products employing soya beans as an ingredient, either to increase their nutritive value or to secure certain desirable physical characteristics, or both, include: candies, beverages, chocolate, health drinks, ice cream cones, ice cream powder, macaroni products, seasoning powders, and soya sauces. This last-named product is made from fermented soya beans, as are many other foods, popular chiefly in the Orient.

Soya Bean Oil and the Paint Industry

In addition to all these methods of utilisation, which employ the ripe, dried beans, soya beans are also used as a green vegetable, in salads and in soups. Despite the uses already listed, the present utilisation of soya beans in food products has only scratched the surface, as new uses are announced daily. Finally, from the economic side, the use of soya beans is practical and logical as a comparison of soya beans to other edible common products shows economical as well as nutritive advantages.

Soya bean oil is not ideal for paint use because of poor drying qualities, stated E. E. Ware, but it does possess the excellent characteristics of permanent elasticity and freedom from discoloration. At present it is seldom used alone; it is either blended with oils of better drying qualities or as a constituent of a synthetic resin vehicle. The utilisation of soya bean oil in paints and varnishes will progress through pressure of popular opinion and as a result of agricultural and industrial research in the improvement of the product.

Solvent Extraction of Soya Beans

Various constructions of continuous extraction apparatus utilise the same general principle of a solvent flowing through the material and the extractor in continuous countercurrent. In the Hildebrandt system, most generally used in the United States, seed is moved through a U-shaped cylinder through which benzine flows in the opposite direction. In drying the extracted meal, the benzine is entirely removed by the heating. The oil mixture is cleaned, decoloured, and the benzine is separated by continuous distillation.

The development of the process of continuous extraction by solvents has resulted in the following advantages over the old expeller process: a greater net profit from a larger yield of oil; a smaller production cost; the production of a higher quality of oil; and the production of lecithin from soya bean oil. Oil residue in extracted mean is low, maximum 0.8 per cent., whereas the oil residue in press cake at the minimum is 5 per cent. The price for the extracted meal, even lower in oil content, is the same as for the press cake; hence the greater oil yield is net profit. The production cost by extraction is less because of less labour involved, practically no depreciation or repairs in machinery, the maintenance of little driving power, and less consumption of steam during the actual production period and in the elimination of the predrying period necessary in the expeller process. The only loss in production is in the loss of the solvent, which under a good extraction system should not exceed 0.6 per cent. of the weight of beans worked.

By the extraction method, approximately a 100 per cent. yield of lecithin content of soya beans can be produced, according to a paper by N. T. Spoerri, whereas it is well known that lecithin production from soya bean oil is impossible by the old expeller process. At present there are available satisfactory solvents and adequate machinery to effect complete removal of solvents from the products.

Experimental feeding tests have substantiated the conclusion that extracted soya bean meal is at least equal in feeding and growing-up value to any other oilseed meal with a higher fat content, for the main feeding factor, protein, can be consumed and transferred biologically to the extent of more than 90 per cent., the important carbon hydrates appear as dextrins and crystalline sugar. Present trends are from pressing to a combination of pressing and extracting or to exclusive extraction.

Soya Bean Oil in the Food Industry

The production of soya beans in the United States has developed from a crop comparatively unknown only a few years ago to one of over 30,000,000 bushels in 1935. The utilisation of this new crop has presented a challenge to industry which has been met by the use of soya bean oil in paints and in food products. The oil is obtained from the bean by high-pressure expellers, hydraulic pressing, or solvent extraction, the former being the process most generally used in this country.

Crude soya bean oil, stated M. M. Durkee, contains about 0.5 per cent. free fatty acids, 0.1 per cent. moisture and volatile matters, 2 per cent. phosphatides, and is of a rather dark colour. For food purposes the crude expelled oil is refined. The five main steps in this process are neutralisation, washing, bleaching, winterisation and deodorising. These are described briefly. The fresh, refined oil is sweet, has a low fatty acid content, and can be made almost water-white. A dark type of soya bean oil found an early market in the manufacture of oleomargarine since it imparted a butter-like colour to the finished product.

A considerable volume of refined soya bean oil is now marketed as a salad or cooking oil, especially in large industrial centres where the turnover is rapid and where the foreign population does not object to the slight but characteristic flavour that develops as the oil ages. Large quantities of soya bean oil are used in the manufacture of vegetable shortenings. It is blended with cottonseed or other oils up to 10 to 15 per cent., and complaints as to the reversion taste are becoming less frequent as manufacturers become more accustomed to its use.

Refined soya bean oil has a greater degree of stability against development of rancidity due to oxidation than most food oils, which, in view of its high percentage of unsaturated acids, shows that it must contain some natural inhibitor which is resistant to the refining process. The development of a reversion flavour in this oil is evidently not the same type of reaction as that ordinarily causing rancidity. This reversion flavour may be connected with the highly unsaturated glyceride of linolenic acid, a glyceride not present in the

commonly used food oils. The prevention of this so-called reversion flavour development in refined soya bean oil is a major problem. A solution may perhaps be found in partial hydrogenation, but experiments along this line have not been entirely successful. When this problem is solved, refined soya bean oil will take its place among American food oils on a par with corn and cottonseed oil

Soya Bean Oil for Soap Making

In spite of the 124 million lb. of soya bean oil used in 1917 in the United States for soap making, and the 9 million lb. used for the same purpose in 1932, nothing has been published on this subject by the experts. The lathering capacity of soya bean oil soap is practically not affected by the hardness of the water, and some coconut and palm kernel oil can be substituted by our domestic soya bean oil for soap making purposes, according to A. A. Horvath. The lathering capacity of soap from soya bean oil varies with the degree of hydrogenation. The caustic soda lye used in the saponification of soya bean oil should not be over 8.5° Baumé. At a higher concentration of lye a partial saponification combined with a salting out effect takes place. For curd soaps soya bean oil should be used only in mixtures with other fats and oils. Soya bean oil is very suitable for the manufacture of soft soap, in particular the automobile variety. Since lecithin is a Twitchell catalyst poison, solvent-extracted soya bean oil should be freed of the phosphatides before being subjected to hydrolysis by a sulfoaromatic catalyst.

Soya Beans as Human Food

Soya beans as food are still little known to American people. Their cultivation has thus far been concerned with crop problems and industrial uses, and for this reason little encouragement has been given to selecting or breeding varieties to be planted on the basis of their possibilities as food. Varieties of both "vegetable" and "commercial" types, numbering almost one hundred in all, have been examined by several means which are thought to give indication as to whether the planting of a given variety for food purposes might be encouraged.

Proximate chemical analyses by Sybil Woodruff and Helen Klaas have been made of eleven edible varieties of soya beans in the green immature stage and also in the fully ripened one. In palatability, as determined by organoleptic means, the different varieties of green soya beans ranked this year; 32 good, 43 fair, 20 poor. As dried, mature ones they ranked: 29 good, 33 fair, and 16 poor. Samples of some were not available in dry form. The duration of the period over which green soya beans were in the best condition for use varied with different ones from 8 to 16 days.

Flour was made from 19 varieties of mature, yellow-coloured soya beans on a small laboratory scale after the beans had been treated for disembittering purposes. A few commercially made flours were studied alongside those made in the laboratory. Differences in both flavour and other points of behaviour were considered to be important here. The varieties were not even alike in the ease with which they could be reduced to a flour; in colour the flours ranged from a greenish mustard yellow to a deep ivory. The moisture-absorbing capacity of a flour was determined by measuring the volume of the centrifugate from a water supension of flours. The free fatty acid number of the flours was apparently not an index of quality in flavour.

Raw and Heated Soya Beans

The improvement in the nutritive properties of soya beans brought about by heating has not been adequately explained, stated C. L. Shrewsbury and E. B. Johnson. Experiments in which rats were fed purified rations of 12.5 per cent. protein content containing raw soya beans, raw soya beans supplemented with cystine, autoclaved soya beans, and autoclaved soya beans supplemented with cystine demonstrate: (1) that heating produces a definite change in their nutritive value; (2) that autoclaved soya beans exhibit a cystine deficiency which is qualitatively and quantitatively similar to the cystine deficiency of raw soya beans.

The Royal Institution

Further Expansion of Research Work

THE annual meeting of the Royal Institution of Great Britain was held on May 1. In the unavoidable absence of the president, Lord Eustace Percy, the chair was taken by the treasurer, Sir Robert Robertson. The annual report of the visitors referred to the improved attendance at lectures which had been noticed in recent years. The recent Christmas juvenile lectures on photography by Dr. Kenneth Mees had an average audience of over 500, and a Friday evening lecture by Sir James Jeans was attended by 640 people, the largest audience seen in the Institution for many years.

The Dewar Research Fellowship has been set up under the legacy of the late Lady Dewar, and the first Dewar Fellow, Mr. A. R. Ubbelohde, B.A., B.Sc., lately Senior Scholar of Christ Church, Oxford, has now taken up his duties in the Institution. A large part of the valuable legacy to the Institution of Mr. Harry Brown, solicitor, of 8 Sergeants Inn, has been received, and the legacy is expected to amount to between £25,000 and £30,000. With the object of investing this money and of providing for future expansion of research work, the managers have purchased the freehold of 19 Albermarle Street, immediately adjoining the premises of the Institution. The reconstruction of the principal library and other rooms which the managers were obliged to undertake last year, is now in progress and is expected to be completed by the summer. A large new research labratory is being provided as a part of the scheme. By the issue in January last of Volume VII and a separate index volume the publication of Faraday's Diary has been completed.

The following officers were elected for the ensuing year: President, Lord Eustace Percy; treasurer, Sir Robert Robertson; secretary, Major Charles E. S. Phillips; managers, Professor E. N. de C. Andrade, Sir Frederick Berryman, Sir James Crichton-Browne, Dr. Cecil H. Desch, Mr. Arthur Jaffe, Mr. James Kewley, Mr. V. Warren Low, Sir Murdoch MacDonald, Sir Richard Paget, Mr. C. C. Paterson, Mr. R. W. Paul, Professor A. O. Rankine, Sir George Simpson, Mr. W. J. Tennant and Vice-Admiral C. V. Usborne; visitors, Mr. H. T. Davidge, Dr. J. J. Fox, Professor C. S. Gibson, Professor H. Hartridge, Captain H. L. Hitchins, Professor F. L. Hopwood, Dr. R. Lessing, Mr. Arthur Marshall, Mr. F. I. G. Rawlins, Professor H. R. Robinson, Dr. Godfrey Rotter, Mr. W. S. Rowntree, Mr. F. Coston Taylor, Mr. F. Twyman and Colonel W. A. Vignoles.

AT present there are 23 companies in Japan producing calcium carbide, with an aggregate annual capacity estimated at 700,000 metric tons. Current production is at the rate of 280,000 tons per year, or about 40 per cent. of capacity. The latest detailed production figures are for 1933, the total being placed at 255,600 metric tons, of which 112,900 was used for production of calcium cyanamide, 45,900 for sulphate of ammonia, 17,200 for acetic acid, 67,700 for acetylene gas and other industrial purposes, and 11,900 exported. Unofficial estimates placed 1935 output at approximately 300,000 metric tons.

More Plentiful Supplies of Pure Water

Recent Work of the Water Pollution Research Board

THE important contributions of the Water Pollution Research Board of the Department of Scientific and Industrial Research towards the provision of better and more plentiful supplies of pure water by showing how the rivers and streams, on which many depend for their supply, can be kept cleaner, were described by Dr. A. Parker, assistant director of Water Pollution Research, before the London Section of the Society of Chemical Industry on May 4.

The Board, since its formation in 1927, has already carried out successful researches on the purification of sewage, on the purification of waste waters from beet-sugar factories and from dairies and milk-product factories, on water softening and on the causes of the corrosive action of certain waters on mains and service pipes. In addition, a comprehensive survey has been made of the River Tees from its source to the sea, and an investigation is in progress on the estuary of the River Mersey with the object of determining the effects of the discharge of sewage on the nature and amount of the deposits in the estuary.

Saving Water from Beet Sugar Factories

The work of the Board, Dr. Parker stated, has definitely shown that millions of gallons of water used by a beet-sugar factory, which were previously wasted, can be saved and re-used after treatment by a simple and practical process, while, if it is necessary to discharge the water into a stream, it can be satisfactorily purified and serious pollution avoided by percolating filters. Without these discoveries the problem of pollution by beet-sugar factories might, as Dr. Parker showed, be very serious. A factory of average size, handling 1,500 tons of beet per day, uses 3½ million gallons of transport and washing water and a further ½ million gallons of process water every day. Untreated, the transport and washing water may be as strong in its polluting effect on a stream as an equal volume of domestic sewage; while the process water may have a polluting effect five to ten times as great.

Thus the waste water from a single factory may be equivalent in its polluting character to crude domestic sewage from a town with a population of about 300,000 people. If the waste waters from all the beet-sugar factories in this country were discharged into streams they would cause as much pollution as the sewage from a population of four or five million people.

Daily Effluents

The problem of the disposal of effluents from dairies and from factories making milk products has become serious as a result of the rapid development of the industry. In their polluting effect on a stream the washing waters from a depot handling 10,000 gallons of milk per day are equivalent to the domestic sewage from a population of about 1,000 people. At factories making condensed milk, butter, cheese and other products, there are also waste waters from washing evaporators, cheese vats, etc., which are strongly polluting. In the summer months the waste washing waters alone from all the depots and factories in the country must be equivalent in polluting character to the domestic sewage from a town with a population of about one million.

In addition, many factories have in the past discharged such liquids as buttermilk and whey into the nearest streams. These liquids are much more polluting than the waste washing waters. For example, whey is at least 100 times as strong as average domestic sewage, and the whey from a cheese factory using 10,000 gallons of milk per day is equivalent to the sewage from a population of about 40,000. This disposal of whey by discharge into streams must emphatically be condemned. Whey has a food value equal to approximately one-half of that of the milk from which it is derived. It should not be treated as a waste material, but should be used as a food for pigs, for the preparation of dried whey for poultry and cattle food, the manufacture of milk sugar and other similar purposes.

Here again the work of the Board, carried out with the financial support of the Milk Marketing Board and the Scottish Milk Marketing Board, is finding a remedy. Two processes for treatment of milk effluents are being tried out on a large scale in a Shropshire factory. The first process has been found to effect a purification of 97 per cent. and the second a purification of 99 per cent. and makes the water so pure that fish can live happily in the final effluent.

In the course of the survey of the River Tees, Dr. Parker continued, it was found that the chief polluting agents were tar acids, naphthalene and cyanides in effluents from coke ovens and waste pickle liquors from the cleansing of iron and steel with hydrochloric acid. It was shown that the death of fish in the river was chiefly due to the cyanides, but that these could be made much less poisonous by treatment with the pickle liquor and lime. Thus it was shown that one effluent could be used to make another innocuous. It was further concluded, however, that the effluents discharged from coke ovens could be greatly reduced in quantity and possibly avoided by modifications of the methods employed for cooling and washing coke over gas, and by utilisation of waste liquors for quenching coke.

In the process of water softening as ordinarily used in modern household softeners, the water is passed through a "base-exchange" material which takes up the hardness-forming salts of lime and magnesia from the water and replaces them by salts of soda. There are three types of materials on the market—certain natural minerals, treated clays, and synthetic products. Some of the synthetic products are manufactured in this country, but the minerals and treated clays are all imported. During the work on water softening, Dr. Parker said, a method had been devised and patented for the preparation of a good water-softening material from British clays, particularly from Fuller's earth, which had advantages over the imported clays.

A discovery of particular interest is that certain synthetic resins possess marked base-exchange properties. Other resins possess the property of removing acids from water. By passing natural water first through one type of resin and then through the other type, any salts in solution, including those responsible for hardness, can be removed.

Atmospheric Pollution

Minister of Health to open Exhibition

THE most comprehensive educational exhibition dealing with the question of smoke abatement and of atmospheric pollution which has yet been held in this country is to be opened by Sir Kingsley Wood, M.P., Minister of Health, at the Science Museum, London, in October next. It is being specially designed to show the harmful effects of polluted atmosphere on health, buildings, vegetation, works of art, fabrics and food, as well as the difficulty and danger caused to aviation.

Sections of the exhibition are being arranged by the Department of Scientific and Industrial Research, with the co-operation of other official bodies and representative organisations of the electricity, gas, oil and solid smokeless fuel industries.

During the month the annual national conference of the society will be held at the Museum. A special day is to be devoted to discussion of the municipal aspects of smoke abatement by representatives of the 100 municipal authorities throughout Great Britain who are affiliated to the Society. Other days are to be devoted to industrial and domestic as well as general considerations of the problem.

India Importing More Chemicals

Some Comparisons Between 1934 and 1935

FAVOURABLE statistics regarding imports of chemical products during the nine months ended December 31, 1935, are given in a memorandum on the survey of the import trade of India during the first nine months of the fiscal year 1935-1936, prepared by the senior British Trade Commissioner in India, issued by the Department of Overseas Trade.

The trade in chemicals recovered its position during the period under review, from Rs.207.5 lakhs* to Rs.232 lakhs, the majority of the increase taking place under the heading of "Other sorts of Chemicals," which rose from Rs.35.7 lakhs to Rs.47 lakhs. Details of the countries of origin are not available for the majority of these commodities, but figures of the total imports in the two periods under consideration are given below:—

	Nine months to December 31, 1934. Rs. (lakhs).	*Nine months to December 31, 1935. Rs. (lakhs).*
Acids	7.6	9.1
Bleaching powder	8.4	9.5
Carbide of calcium	5.1	5.4
Copper sulphate	2.1	3.
Disinfectants	5.1	4.8
Glycerine	3	3.1
Potassium chlorate	4.7	7.9
Sodium bicarbonate	5.5	6.1
Sodium bichromate	3	2.6
Sodium carbonate	43.4	42.9
Sodium cyanide	2.1	1.9
Caustic soda	32.2	31.6
Sodium silicate	2.2	2.4
Sodium sulphide	1.8	2.7
Sulphur (brimstone)	12.7	15.4

Trade in Drugs and Medicines

The aggregate trade in drugs and medicines showed an increase as compared with the corresponding period of the preceding year, from Rs.140.3 lakhs to Rs.157.3 lakhs. Details of origin are not available for the majority of the items included under this heading. The statement, however, gives particulars of the imports for the first nine months of the two years in question of the principal items included under this heading:—

	Nine months to December 31, 1934. Rs. (lakhs).	*Nine months to December 31, 1935. Rs. (lakhs).*
Camphor	15	16.2
Proprietary and patent medicines	28	48.3
Quinine salts	22.1	20.9
Saccharin	1.9	3.1

Of particular interest is the large increase in the imports of proprietary and patent medicines, which were more than 70 per cent. higher than in the corresponding period of the preceding year. The United Kingdom is the largest supplier under this heading and her shipments advanced from Rs.14.2 lakhs in the nine months ending December, 1934, to Rs.20.3 lakhs in the same period of this year. Arrivals from Germany also rose sharply from Rs.5 lakhs to Rs.11.6 lakhs, and from the United States from Rs.4.3 lakhs to Rs.8.7 lakhs. Imports from "other countries" also rose from Rs.4.5 lakhs to Rs.7.6 lakhs.

There was an increase in the total value of the trade in dyes obtained from coal tar of approximately Rs.5 lakhs, from Rs.210.3 lakhs to Rs.215.5 lakhs, but the United Kingdom improved its trade in a greater proportion. Germany secures the bulk of the imports under this heading, but her shipments decreased from Rs.147.6 lakhs in the first nine months of 1934-35 to Rs.141.1 lakhs in the same period of the current year. As against this, the United Kingdom sent Rs.30.6 lakhs during the period under review as compared with Rs.23.6 lakhs in the same nine months of 1934. Other supplies are Switzerland, which increased its share from Rs.12.1 lakhs to Rs.16.8 lakhs, the United States of America, which sent Rs.8.9 lakhs as against Rs.8.4 lakhs in the previous year, and Japan, the imports from which country fell from Rs.8.6 lakhs to Rs.7.5 lakhs. Arrivals from "other countries" increased slightly from Rs.10.1 lakhs to Rs.10.7 lakhs. The following table gives a comparison of the arrivals under separate categories:—

	Nine months to December 31, 1934. Rs. (lakhs).	*Nine months to December 31, 1935. Rs. (lakhs).*
Alizarine:—		
Moist:		
i. Not exceeding 16 per cent.	1.7	0.3
ii. Over 16 per cent. but not exceeding 20 per cent.	11.1	6.8
iii. Exceeding 20 per cent.	4.7	1.7
Congo red	11.8	9.3
Coupling dyes of the naphthol group:—		
i. Naphthols	18.4	18.2
ii. Rapid fast colours (rapid salts)	2.7	2.3
iii. Bases	6.9	8.3
iv. Other salts	9.8	10.1
Vat dyes:—		
i. Indigo	14.3	12.1
ii. Other sorts:—		
(*a*) Paste	6.7	3.9
(*b*) Powder	50.8	66.9
Sulphur black	7.4	8.8
Metanil yellow	4.8	4.5

Paints and Colours

The trade in paints and colours also registered an increase from 258,355 cwt. valued at Rs.54 lakhs to 267,245 cwt. valued at Rs.58.4 lakhs. The United Kingdom share fell in quantity from 138,090 cwt. to 135,788 cwt., but rose in value from Rs.36 lakhs to Rs.37.6 lakhs. The imports from Germany were reduced from 23,827 cwt. (Rs.5.5 lakhs) to 19,437 cwt (Rs.5.4 lakhs). On the other hand, arrivals from Japan rose from 36,107 cwt. (Rs.5.3 lakhs) to 41,949 cwt. (Rs.7 lakhs), and from the United States of America from 3,962 cwt. (Rs.1.8 lakhs) to 5,961 cwt. (Rs.2.2 lakhs).

The increased local production of soap has had its effect in reducing by half the total value of this trade, which fell from 186,311 cwt. valued at Rs.53.9 lakhs to 46,296 cwt. valued at Rs.26.1 lakhs. The United Kingdom secures the bulk of this trade and suffered the heaviest loss owing to the activities of local manufacturers, her sendings being reduced from 160,325 cwt. (Rs.45.9 lakhs) to 32,659 cwt. (Rs.20.9 lakhs). The reduction in the total trade is mainly due to the very heavy fall in the imports of household and laundry soap, although the indigenous industry also affects the imports of toilet soap. The arrivals of household and laundry soap were reduced from 147,874 cwt. valued at Rs.28.5 lakhs to 10,319 cwt. valued at Rs.2.3 lakhs, whilst the imports of toilet soap also diminished from 34,701 cwt. valued at Rs.24.3 lakhs to 31,817 cwt. valued at Rs.22.5 lakhs.

*Rupees one Lakh (Rs. 1,00,000 = £7,500 at 1/6 exchange. Rupees one Crore = Rs. 100 Lakhs = £750,000.

IN 1935 there were five paint plants located in Shanghai, and a variety of paint products was manufactured by these factories. A new concern is now entering the industry, known as the Orient Paint, Colour and Varnish Co., Ltd. This concern is organised, controlled and managed by British interests and a large modern factory has been started in Shanghai for production of all types of paints, varnishes and lacquers.

Empire Raw Materials

Annual Report on the Work of the Imperial Institute

THE year 1935 showed further progress in investigational and intelligence work on Empire products, states the Annual Report of the Imperial Institute. The work of the Institute is now divided between five Departments—the Plant and Animal Products Department, Mineral Resources Department, the Secretariat, the Exhibition Galleries and the Accounts and Establishment Department—and each head of a department is directly responsible to the director for the work of his department.

Now that some Governments have ceased to contribute to the general revenues of the Institute it has been decided, with the approval of the Board of Governors, to charge fees to such non-contributing Governments on the same principles as to private firms and individuals: that is, to say, the fees are calculated on the existing scales for any work involving a considerable expenditure of time and trouble, while preliminary work easily carried out is not charged for.

Appointments and Retirements

On the retirement of Sir David Prain from the service of the Imperial Institute the secretary of the Department of Overseas Trade appointed Mr. F. A. Stockdale, agricultural adviser to the Secretary of State for the Colonies, to be chairman of the Advisory Council. Dr. D. Jordan Lloyd has been appointed chairman of the Advisory Committees on Tanning Materials and Hides and Skins in place of Sir David Prain.

Dr. Ernest Goulding, who had acted as secretary to the Committee on Vegetable Fibres since its appointment, retired from the service of the Imperial Institute during the year and was succeeded by Dr. S. E. Chandler.

Work on the problems involved in the production of tung oil from the fruits was continued throughout the year by the committee on oils and oilseeds. In this connection further experiments were carried out with the object of perfecting machines which will decorticate the fruits satisfactorily and yield a product suitable for crushing. With a view to obtaining wider experience in the use of an expeller (a type of press which previous tests had shown to be entirely suitable for the preparation of tung oil) a consignment of kernels was forwarded to one of the large firms manufacturing oil-mill machinery who had undertaken to make further crushing trials.

Examination of Oils

The chemical and technical examinations of Empire raw materials of plant and animal origin carried out during the year has been varied. In connection with an investigation into the possibilities of creating a market in the United Kingdom for Indian soya beans three varieties of soya beans—*viz.*, Pusa White, Manchurian and Punjab White—were received through the Indian Trade Commissioner and were found to contain respectively 16.2, 18.8 and 15.6 per cent. of oil. The oils were on the whole of normal character and the residual meals contained satisfactory amounts of protein. All three varieties would be readily saleable in the United Kingdom, the Manchurian type commanding a slightly higher price than the others on account of its higher oil content.

The examination at the Imperial Institute of a small sample of *Cymbopogon afronardus* oil from Kenya having indicated that the oil had commercial possibilities, a larger sample was submitted by the Department of Agriculture for more detailed investigation and commercial valuation. The results of this investigation showed that the oil contained about 63 per cent. of free alcohols, consisting mainly of geraniol, and about 22 per cent. of esters expressed as geranyl acetate. The odour of the geraniol compared favourably with that isolated from commercial palmarosa and citronella oils, and firms of essential oil dealers, distillers and soap manufacturers who were consulted agreed that the oil might be utilised as a source of geraniol if it could be offered at a somewhat lower price than palmarosa oil.

Samples of geranium oil distilled experimentally from several different species and varieties of *Pelargonium* were sent by the Agricultural Officer at St. Helena. Three of these oils were found to be promising and of possible commercial interest, but they differed from Algerian and Bourbon geranium oils and would have to be offered at prices below those ruling for these commercial oils. Further trials with an improved form of still are desirable before any decision can be reached as to the possibilities of geranium oil production in the island.

The number of inquiries dealt with by the Intelligence Staff of the Plant and Animal Products Department during the period under review was 1,130. As in previous years, requests for information as to the commercial position of overseas products and the opportunities for marketing supplies in the United Kingdom occupied an important place in the year's work. Such inquiries are not necessarily concerned with proposed new local industries, but commonly relate to established industries affected by changes in commercial conditions or to undertakings which are emerging from the early stages and need to be directed along right lines.

Lemon Cultivation

In regard to a proposal to extend the cultivation of lemons in Southern Rhodesia with a view to the production of oil of lemon and lemon juice, the High Commissioner was furnished with information concerning the market in the United Kingdom for these products, and an outline was given of methods of preparation, yields and mode of packing. Attention was drawn to the importance of marketing the fresh fruit as the basis of a lemon industry and reference made to Sicilian practice in this respect. Names of firms which had offered to handle lemon products from Southern Rhodesia were given.

The advice of the Imperial Institute was sought by the Department of Agriculture in Palestine in regard to proposals for planting pyrethrum on a large scale by local organisations. Information was furnished as to the present position of the world market for pyrethrum, its special uses, and the extent to which it is likely to be replaceable by other insecticides.

A firm manufacturing linoleum and other floor coverings required particulars as to sources of supply of "sulphite glue." They were informed that the material is a by-product of paper-pulp manufacture; samples of the various grades on the market were obtained for them and they were put in touch with a firm offering supplies.

The intelligence staff of the Mineral Resources Department is responsible for the collection and dissemination of information concerning mineral resources in general and those of the Empire in particular. It supplies information mainly of a technical and commercial character, not only to Government Departments, but also to firms and private individuals both in the United Kingdom and overseas, and for this purpose maintains a technical index containing references to journals and other publications relating to the many aspects of mineral resources. During the period under review the number of inquiries dealt with numbered 734.

The Director of Agriculture, Kenya, was supplied with a list of publications dealing with clays and their use in pottery manufacture, together with reports on tests made at the Institute on clays from certain dominions and colonies.

A director of an important British firm contemplating the

manufacture of paints in the Union of South Africa was given information regarding the occurrence of many possible raw materials in South Africa, together with such statistics of trade as were available. Information regarding the nature and use of bentonite, methods of testing and references to literature on the subject were given to the Acting Government Mining Engineer, Kenya, who was also furnished with a typical sample of the mineral.

Although there is but little market in the United Kingdom for industrial beryl, a number of inquiries have been received regarding the uses and demand for this mineral from various sources.

Information was also supplied on a number of questions regarding mining laws in the Empire. The subjects included conditions for the issue of exclusive prospecting licences in Nigeria, prospecting in Ashanti, royalties on gold, silver and tin in the United Kingdom, terms of mining leases in West Africa.

Activities of Unilever, Ltd.

Soap and Margarine Sales make Fresh Records

PRESIDING at the eighth annual general meeting of Unilever, Ltd., at Southern House, Cannon Street Station, London, on Wednesday, Mr. F. D'Arcy Cooper said that soap, margarine and refined and hardened oils remain the mainstay of the company's business. Approximately 90 per cent. of the soap business is carried on directly or indirectly by Lever Brothers, Ltd. Outside the Lever business the company sells approximately 75,000 tons of soap, and the total quantity of soap sold by all associated companies, including Lever Brothers, was this year 6.4 per cent. in excess of the tonnage for 1934.

The turnover of margarine has increased by 35,000 tons, the biggest increase being the United Kingdom, namely, 19,000 tons. This is a satisfactory omen for the future, as England is one of the few countries where butter and margarine are sold in free competition. Unilever factories for refined and hardened oils produced 420,000 tons for sale to third parties, apart from oils produced as raw material for their own margarine and soap factories. This output is 30,000 tons more than in 1934. A substantial quantity of the world's glycerine production also comes from the company's factories, the output for 1935 having been 9.4 per cent. in excess of that for 1934. Supplies of acid oils to third parties increased by 2.8 per cent.

The Southern Whaling and Sealing Co. had a satisfactory season, and this notwithstanding the compulsory restriction of the catching period. Two fleets, consisting of two large floating factories and sixteen whale catchers, brought home a quantity of 44,000 tons of whale oil.

Canning Industry Activities

Interests in the meat business are held by associated companies of Unilever, Ltd., in England and Holland. They produce chiefly sausages, bacon and tongues, the combined tonnage sold to third parties exceeding 18,000 tons, an increase of 32 per cent. over 1934. The canning industry is also of growing importance, and the company's interests extend over various countries and sales of canned fish approximate to £2,500,000 per annum. Vegetables are also being canned, but are of less importance. The tonnage of canned fruit and vegetables sold last year was over 23,000 tons. Cheese is also produced in a number of factories, chiefly in Germany, but also in England; the sale now averages 150 tons per week. The manufacture and sale of ice-cream has become an important industry, and from 6,000 to 7,000 people are employed in this trade. Production of condensed milk shows a decrease, both in turnover and in profit, as compared with 1934, but the sale of other milk products, and particularly of baby food, developed satisfactorily, the latter increasing by about 5 per cent. in turnover.

Unilever factories engaged in the chemical industry produce among other things caustic soda, silicate of soda and water-softeners. The profit on the sale of chemicals represents a very adequate return on the capital invested. The same can now be said of the production and sale of charcoal, bone meal and fertilisers. Unilever interests in fertilisers are chiefly held by French associated companies and extend to various parts of the world, particularly the South Sea Islands; during 1935, 130,000 tons were sold.

Unilever, Ltd., have interests in various factories both on the Continent and in England for filling requirements for packing the company's main commodities—margarine and soap. They comprise factories for the manufacture of boxes and other articles from wood, tin-making plants, factories for the production of cellulose and parchment paper, printing works and boxboard factories. In some cases, considerable sales of the articles produced are made to third parties, so much so that sales within the group in the case of one unit, built at a cost of well over £1,000,000, represent not more than 17 per cent. of its total output, and a second unit is now under construction to meet the growing demand.

Viatmins and Pharmaceutical Products

In the pharmaceutical field the company has built up an interesting trade in vitamins. Apart from supplying their own margarine factories, which are now using large quantities, sales are made wholesale to other manufacturers and retail to chemists under a brand, and profits are satisfactory.

Closely associated with the soap industry is the manufacture of perfumes and toilet preparations. These include face creams and eud de Cologne. The latter enjoys a growing popularity, particularly in the various States of South America, where an associated company owns several factories for the production of this and similar articles.

Gift of £250,000 to Cambridge

Sir Herbert Austin and the Cavendish Laboratory

SIR HERBERT AUSTIN has given £250,000 for scientific research at the University of Cambridge. In a letter to Mr. Stanley Baldwin, Chancellor of the University, Sir Herbert wrote: "I have for several years been watching the very valuable work done by Lord Rutherford and his colleagues at Cambridge in the realm of scientific research, and knowing that as Chancellor you are keenly interested in obtaining sufficient funds with which to build, equip and endow a very much-needed addition to the present resources, I shall be very pleased indeed to present securities to the value of approximately £250,000 for this purpose."

Mr. Baldwin's reply was as follows:—"As Chancellor of the University of Cambridge, I gratefully accept on behalf of the University your most generous offer of £250,000 towards the extension and further endowment of the Cavendish Laboratory. There can be no greater encouragement to the men who devote themselves to scientific research than to feel that their work is appreciated by those engaged in industry, the progress and development of whose businesses depend so much on the laboratories of our country. Your noble gift will be invaluable at this time to Cambridge, and the benefits arising from its applications will be available for the civilised world."

Special Lead Section

A REVIEW OF THE APPLICATION OF LEAD AND ITS ALLOYS IN CHEMICAL ENGINEERING PRACTICE

Foreword

By F. H. A. MACKRILL, Chairman of the Lead Sheet and Pipe Development Council

LEAD as a medium for the construction of chemical plant has been in use from the earliest days of chemical practice, but I believe this is the first occasion on which a special supplement of a technical journal has been exclusively devoted to an examination of its service to the chemical industry. The corrosion resistance of lead has been known for centuries; in fact the Egyptians used lead pipe to distribute water. To come nearer home there is ample evidence of the working of English lead mines by the Romans. The famous bath at Bath is even now being fed by a Roman-made lead pipe.

In considering lead as an essential material in the construction of chemical plant the mind of the chemical engineer naturally turns to its wide use in connection with the manufacture of sulphuric acid, its most extensive application in the chemical industry. It was used in sulphuric acid plant quite early in the eighteenth century, and had been definitely adopted for that purpose by 1746. Its real value lies in its resistance to corrosion, its ease of working and its usefulness for jointing. It can be shaped or moulded with ease and its low melting point makes jointing very simple.

Chemical lead has been purified to an extraordinarily high degree and lead manufacturers to-day are able to guarantee a purity as high as 99.99 per cent. Whilst such metal has proved itself an excellent material for many purposes it has been found that resistance can be still further increased by the addition of small percentages of certain metals, modern developments in this direction including copper-lead, nickel-lead and tellurium-lead, whilst an older process is that of adding antimony.

The latest British Standard Specification (No. 334 of 1934) provides for two types of chemical lead; type "A" is a pure material containing metal of not less than 99.99 per cent. purity, whilst type "B" is a metal called "chemical lead containing protective elements." That specification, drawn up by all the big users and manufacturers in the country, represents present knowledge with regard to chemical lead, and summarises the developments that have taken place. Incidentally, British chemical lead has attained a very high reputation all over the world, as evidenced by the wide distribution of exports.

Recent years have seen the formation of the Lead Sheet and Pipe Development Council, which represents substantially all the manufacturers of lead sheet and lead pipe in the country. One of the main objects of the Council is to give reliable information to users and potential users of lead as to the correct methods of using it. The reason for stressing this aspect of the Council's work is that generally speaking it has been found that in the rare cases where there have been failures in the use of lead the cause has almost invariably been faulty application rather than faulty material. There are circumstances in which the use of lead is unsuitable, and the Council frankly advises its inquirers where this is the case.

Many of the large lead producing companies which constitute the Council carry on extensive research establishments of their own, and those companies which are also members of the British Non-Ferrous Metals Research Association have the benefit of the work carried on by that organisation. One leading company devotes a half of one of its laboratories solely to research on lead.

It will be seen, therefore, that all these activities place the Council in a position to be in the forefront of all the latest practices and developments and enable it to give the best available advice and information to those who desire it.

New Lead Alloys and their Application in the Construction of Plant

By D. W. JONES

LEAD and its alloys have long enjoyed an honourable place as constructional materials in chemical plant. In days now long past these metals and alloys had few competitors, but with the more recent introduction of many other acid-resisting materials—all very much cheaper than the one time extensively used platinum—it must be expected that research would be directed towards providing lead or an alloy of lead better suited to meeting the severe demands of modern conditions in which less and less of the metal is used per unit of product manufactured.

People of long experience in the use of lead have stated that an unaccountable failure of the metal was unknown to them, but when put to work continuously at a temperature of one-third of its melting point, a long life of service could not be expected, especially if vibration effects became a contributory cause of destruction. To be acceptable in the fullest sense the valuable properties of lead, easy fabrication, safe and sure joining of fabricated parts by lead burned joints, and amenability to casting must be preserved, without depressing the resistance to corrosion, especially at a temperature of 110° C. or over.

Lead of high quality, that is, refined or super-refined, is available in quantities equal to any conceivable demand. The B.S.I. Specification No. 334 (1934) demands a lead content of 99.99 per cent. in chemical lead, type "A," and insists on limitations in the amounts of twelve impurities which may be present. Recognising the fact that additive elements can confer outstanding properties on lead, the specification provides for this by including chemical lead, type "B," defined as follows:—"Chemical lead containing protective elements, the composition of which material shall be agreed between the manufacturer and the purchaser, but should not contain more than 0.005 per cent. bismuth."

The introduction of copper (up to 0.5 per cent.) to lead to increase corrosion resistance has been practised for many years. C. E. Barrs showed in 1919 that copper acted benefi-

cially in creating resistance to attack by concentrated sulphuric acid over 300° C. and found that tellurium had the same effect. It was thought that increased strength was imparted to lead by the small amount of copper used, but it is certain that the tendency to recrystallisation at working temperatures in various processes where lead is used was not prevented, and when under stress inter-crystalline cracking of lead containing copper could occur. It is interesting in this connection to note that in the United States the most acceptable grade of chemical lead is one derived from the smelting of natural ores and not submitted to special refining, and which contains copper up to 0.08 per cent., silver 0.02 per cent.

Of more recent origin and developed in Germany is a nickel lead which contains a maximum amount of 0.05 per cent. nickel, the nickel being deliberately introduced. Nickel lead as made in England has a maximum content of 0.005 per cent. Here again, although resistance to corrosion is of a high order, the physical characteristics of this lead are not markedly changed. An unsustained application for a British patent emanated from Belgium. The claim was for the merit of lead containing 0.01 per cent. nickel, 0.05 per cent. copper and, surprising to say, 0.50 per cent. bismuth was tolerated. Little, if any, of this type of chemical lead has been used in this country.

The British Non-Ferrous Metals Research Association has developed the so-called ternary alloys of lead, of which there are three. Nos. 1 and 2 are best known and the composition and some physical properties are given below :—

	Composition.				Tensile Strength. lb. per sq. inch.	Fatigue Resistance (Haigh Fatigue Test). Tons per sq. inch.
No.	% Tin.	% Anti-mony.	% Cad-mium.	Lead.		
1	—	0.50	0.25	Remainder	3696	0.74
2	1.50	—	0.25	,,		
3	0.40	—	0.15	,,	3024	0.35

These figures indicate tensile strength about twice that of pure lead. Sheet and pipe made in ternary alloys are stiffer than lead sheet and pipe, but are tractable in working and offer no difficulty in burning or soldering. The material may not be sufficiently resistant to corrosion to warrant extensive use in the chemical trade, but has been applied to water services and the like where vibration has to be withstood. Ternary alloys are more expensive per unit weight than ordinary lead, but are put into service in lighter weight than ordinary lead. There is therefore no wide difference from the point of view of cost. Ternary alloy sheet is not used to any great extent.

Antimonial Lead Alloys

In almost every conceivable proportion, up to 30 per cent., antimony is alloyed with lead for purposes of constructing chemical plant. The alloy containing over 8 per cent. antimony is generally used in the cast form. An alloy under 8 per cent. antimony may be cast, extruded or rolled. Very many small parts are produced by die-casting. Heavy vessels, sometimes made up from antimonial lead sheet and one-inch section, are frequently used and are sufficiently rigid to find a place in film evaporators for storage purposes, and many pipes in the alloy are also employed. Antimonial lead can be joined in the usual way by the lead burning process.

An alloy containing 4 per cent. antimony or more can be satisfactorily screw-cut, but there is a danger of seizure when nuts are drawn up very tightly on threads in antimony-lead alloys. Valves, injectors and cocks made from lead with 12 to 20 per cent. antimony are very extensively used in controlling the flow of cold sulphuric acid.

The artificial silk industry makes extensive use of antimonial lead alloys. Nozzles with a large number of fine holes can be made from an alloy of 28 per cent. antimony. Rounder ends—a tubular and shaped connection which will swivel through an angle of 90°—are made in antimonial lead, which resists corrosion by 10 per cent. sulphuric acid, and possesses sufficient strength to permit of frequent movement. Other and more expensive materials have been replaced by the alloy for this particular purpose.

Some ten years ago it was commonly stated that homogeneous lead lined steel and cast iron plant for the chemical industry was unobtainable in Britain. To-day there are at least seven reputable firms who undertake this work, in which the lead is attached to steel so securely that separation of the two metals is only brought about by hammer and chisel, and even then there is no clear line of demarcation between the two surfaces. The early process included a wash of tin next the steel surface, and sometimes a reinforcement of wire. The art has progressed to such an extent that by fluxes alone lead is firmly attached.

The advantage of a strong outer shell with a rigid lining of corrosion-resisting lead is obvious, and homogeneous lead-lined plant is particularly applicable to operations conducted at fairly high pressure or under vacuum, and where temperature alternates between 100° C. and atmospheric. When a piece of plant is in two parts and jointing is by flanges and bolts the edges at and near the flanges are sometimes coated with antimonial lead which, being harder, resists the effect of pressure when bolts are drawn up very strongly. Alloys of the order of 4 per cent. antimony are best suited to this purpose.

Tellurium Lead

The most important development in alloys of lead in recent years is based on the observations that so small a quantity as 0.05 to 0.065 per cent. tellurium introduced into lead effects profound changes in the physical properties of the metal without sacrifice in corrosion resistance, whilst still preserving the essential properties of lead.

Tellurium added to lead effects the following fundamental changes in the physical structure of the material : (1) Grain is refined in a remarkable way. (2) The temperature at which recrystallisation occurs is raised very appreciably. (3) Work-toughening properties are imparted. (4) Tensile strength is practically doubled and more than doubled at 100° C. (5) Resistance to fatigue is increased almost three times at ordinary temperature and four times at 100° C. when compared with ordinary lead used under the same conditions.

A. R. Melville (" Some Industrial Uses and Characteristics of Lead and its Alloys ") states that tellurium lead has elasticity. No measurements are given and until these are available judgment in this connection should be suspended. The outstanding differences between ordinary and tellurium lead which may be expected from a study of the foregoing are shown in the photographs reproduced in the following page and in the tables below :—

	Lead Sheet.		Tellurium Lead Sheet.	
	Tensile Strength lb. per sq. inch.	% Elonga-tion (a).	Tensile Strength lb. per sq. inch.	% Elonga-tion (a).
Ordinary Tempera-ture	1570	49	2700	48
At 100° C. ..	804	51	1700	43
24 hrs. at 100° C.	765	46	1670	47
100 ,, ,, 100° C.	820	50	1610	38
200 ,, ,, 100° C.	730	54	1610	33

(a) Rate of elongation = 0.022 inch per inch per minute.

+ Fatigue Resistance (Haigh Fatigue Test). Expressed as tons per sq. inch.

	Lead.	Tellurium Lead.
Ordinary Temperature	*0.18	0.50
At 100° C.	*0.086	0.33

* Taken as the range of stress which will cause failure after 10 million reversals.

Figs. 1 and 2 demonstrate the difference in grain size between chemical and tellurium lead pipe as manufactured. Figs. 3 to 6 prove serious grain growth in chemical lead and very slight growth of tellurium lead at high temperatures. Fig. 7 shows the weakness created through bending, chemical lead and its lesser elongation.

Reduction of grain size combined with greater toughness means in general application that uniform instead of localised corrosion can be expected, and that erosion can be withstood

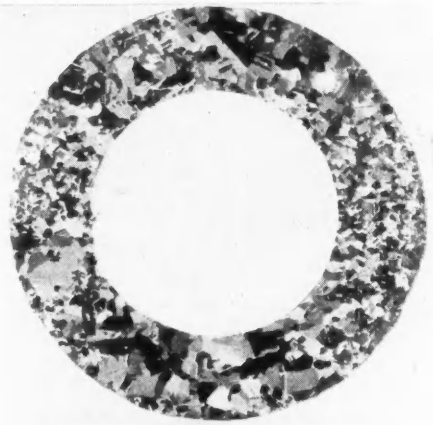


Fig. 1.—Lead pipe section × 3.

Fig. 2.—Tellurium lead pipe section × 3.

Fig. 3.—Chemical lead sheet section × 3.

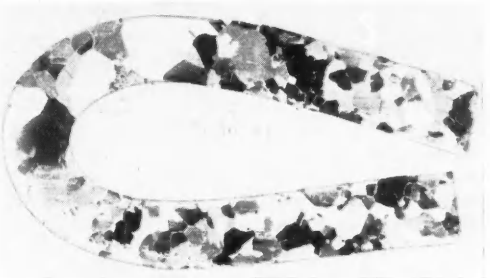


Fig. 4.—Chemical lead sheet section, annealed 200° C. × 3.

to a much greater extent. The increased temperature of recrystallisation of tellurium lead and the property of work-toughening allow this new alloy to be used in plants at higher temperatures or point to a longer life at the same temperature, while thermal creep, a real difficulty in some uses if not eliminated, is of a very small order.

The work-toughening which takes place during the fabrication of plant in tellurium lead, translated into terms of usefulness, means that maximum strength is developed, and thereby the danger of a thinned-out area, easily brought about by the ready stretch of ordinary lead during working, is removed. The value of tensile strength which is 100 per cent. greater in tellurium lead when employed at 100° C. is not easily expressed. Resistance to "fatigue" is a measure of the power to withstand the effects of vibration—a difficulty often ineradicable in plant construction. The high fatigue resistance of tellurium lead is of fundamental importance.

When rolled in the form of sheet, tellurium lead is stiff due to work-toughening which takes place in the operation of rolling. Sheet so made can be softened by annealing. The tensile strength of rolled sheet is 5,000 lb. per sq. in. By annealing, a range of 2,500-5,000 lb. per sq. in. can be obtained depending on the measure of annealing. Experience has proved that tellurium lead sheet of tensile strength of the order of 2,700 lb. per sq. in. is most acceptable. Lead-burned joints in tellurium lead are best made with a slightly reducing flame, and if built up with strip this should be of pure lead. Whenever possible the joint should be hammered in order to develop the property of work-toughening. Tellurium lead has been extensively used in the chemical industry for the past three years—often in positions where other lead or alloys of lead failed in a short time. In the bulk of such cases tellurium lead has proved to be much superior. It is now possible to say that many failures due to corrosion, erosion, thermal creep and vibration can be avoided, meaning at the same time much has been done to augment the quantity of lead made and used in this country.

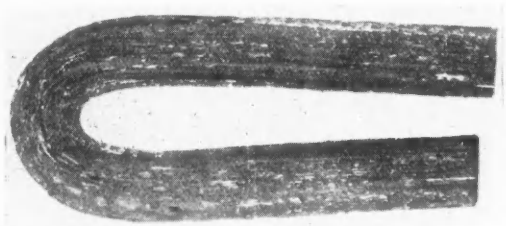


Fig. 5.—Tellurium lead sheet section × 3.

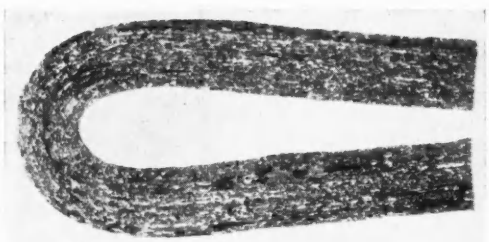


Fig. 6.—Tellurium lead sheet section, annealed 200° C. × 3.

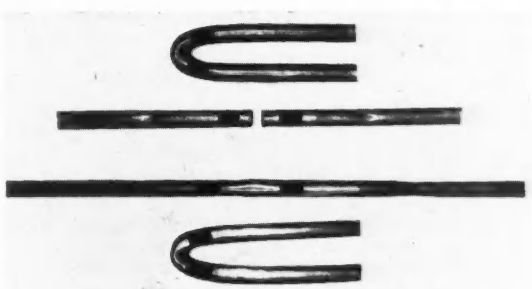


Fig. 7.—Lead and tellurium lead pipes, bent double and then elongated to fracture.

Lead in the Construction of Sulphuric Acid Plants

By P. PARRISH, F.I.C., M.I.Chem.E., M.I.Gas.E., F.I.I.A.

WRITING on the subject of the draft revision of B.S. Specification No. 334 for "Chemical Lead," I ventured to remark: "Any specification for chemical sheet lead which ignores the physical and mechanical factors cannot be regarded as complete. In point of fact, the latter factors are almost as important as the chemical tests, which are so carefully elaborated in the draft revised B.S. specification in question."

Chemical lead, as used in the construction of sulphuric acid plants, varies widely in grain size, and is susceptible to grain growth and recrystallisation at ordinary temperatures. Where grain size varies widely, there is a predisposition to inter-crystalline cracking. The grain size of "Tandac" pure ingot lead (an electrolytically-produced lead—perhaps the best of its kind in the world), is of the order of 400 to 1,000μ. (The particle size of any body is usually expressed in terms of the Greek letter μ, which equals one micron, which, in turn, is 10^{-3} mm., which represents 0.001 mm.)

The particle size of Edelblei is 40 to 150 μ. It is unnecessary to stress what the advantages of a chemical lead are, other things being equal, which has a particle size of 0.04 to 0.150 mm., as against the chemical sheet lead largely available in this country to-day, of 0.4 to 1 mm. Where the grain size is as large as is represented by the latter figures, it is evident that there must be (a) mechanical weakness at ordinary temperature, (b) increased mechanical weakness at raised temperatures, (c) a premature tendency for recrystallisation to occur, and (d) low stability towards hot concentrated sulphuric acid.

Results of Fatigue Tests

Fatigue tests have been conducted on various qualities of chemical sheet lead by Professor Haigh, and some results are indicated below:—

Ordinary chemical soft lead.

Fatigue value: + or − 0.18 ton per sq. in./10 minute cycle.

Antimonial lead, with 1 per cent. antimony.

Fatigue value: + or − 0.62 ton per sq. in./10 minute cycle.

Tellurium lead.

Fatigue value: + or − 0.5 ton per sq. in./10 minute cycle.

It is difficult to give figures about the tensile strength and elongation of chemical lead, because of the variabilities of physical characteristics. Assuming a test speed of 2-in. per minute, the tensile strength of a normal chemical lead can be taken as approximately 2,200 lb. per sq. in., with an elongation of about 17 per cent. on an 8-in. gauge length. Under similar conditions, tellurium sheet lead, in the toughened condition, would give a tensile strength of 4,000 to 4,500 lb. per sq. in., with an elongation of about 12 per cent., and in the fully-annealed condition, a tensile strength of about 2,700 to 3,000 lb. per sq. in., with an elongation of 30 to 35 per cent., on a gauge length of 8 in.

Edelblei (a German chemical lead, containing about 0.015 per cent. of nickel, introduced essentially with a view to reducing the grain size, and ensuring its uniformity), gives a rather better value than ordinary chemical sheet lead.

Hitherto, the bulk of the lead employed in chemical works has been of the soft chemical lead quality. The low tensile strength should constitute no hindrance to its use. Wherever it is employed in positions in which it is subjected to stress, suitable means can be devised for supporting it satisfactorily. When it is used in warm situations, it must be supported in all directions. A circular trunk, when built of lead to pass hot gases, will not long retain its shapely form, except it is well supported. Such support should be so arranged as to admit of the satisfactory dissipation of heat. The expansion of chemical lead should not be overlooked. Lead expands readily enough, but it does not reveal the same tendency to contract. It is necessary to legislate for this property.

The late Geo. E. Davis emphasised that "softness, plasticity and ductility in a high degree were properties of chemical lead which rendered it a most valuable metal in the hands of a good plumber." Unfortunately, the introduction of tellurium imparts a degree of hardness, and absence of ductility, which render such chemical lead very difficult to work. Indeed, chemical plumbers have difficulty in making a bend, or in dressing the lead to a pre-determined shape. The attempt to overcome this disability of "hardness" by annealing, while it may be effective for a time, does not appear to be permanent. Any improvement of uniformity, and reduced grain size and mechanical strength, should not be accompanied by any disability in the working of the lead, otherwise its popularity is bound to suffer.

Changes in Design

Up to 1910, sulphuric acid chambers in this country and on the Continent were constituted of a wooden skeleton framework arranged in order to support the lead. The supporting straps were usually discontinuous: in some cases they were autogenously soldered and attached to vertical members of the wooden skeleton framework: in other cases they were attached to horizontal members. Sulphuric acid chambers in those days were usually rectangular in sections of varying lengths and widths, but usually not more than 18 to 20 ft. high. A later tendency was to erect the chambers 30 ft. or more high, because it was recognised that the number of British thermal units transmitted per unit of cubic capacity, depended on the available surface area for heat dissipation.

The next advance was to use continuous vertical straps for supporting the side sheets, in which a light steel flat was covered with lead and burned to the side sheet, and was suitably supported from the top. These vertical straps were arranged at centres of about 2 ft. or 2ft. 3 in. throughout the length of the chamber. The tops were slightly domed and were supported by continuous light curved flats, lead-covered and autogenously soldered to the top, at intervals of about 2 ft. or 2 ft. 3 in. This arrangement of chamber (Fig. 1) represented a marked advance on anything hitherto attempted in the construction of sulphuric acid chambers. Not only was the whole of the lead presented to view, but it was easily accessible, and it afforded that flexibility yet withal adequacy of support which are so essential to the longevity of the lead. Moreover, it admitted of better cooling than was formerly possible, particularly if arrangements were made for cold air to enter the gangway, and to discharge itself through a louvre arrangement at the top.

Current Practice

In the construction of such chambers, the lead wings were soldered to the lead sheet on the ground. The sheet was then rolled on a mandrel. The lead was unrolled like a theatre curtain and placed on a wooden table, which was reared by block and tackle, and swung into position, the lead-covered straps being attached to the hangers, usually suspended from the roof trusses. This method of erection was simple, and reduced the use of scaffolding to a minimum. But high chambers, however attractively constructed, which merely depended on air cooling, were too expensive in capital cost, because they did not admit of intensive production of sulphuric acid. Later they were displaced by water-cooled or acid-cooled tower chambers. This brings us to current practice, as is exemplified by the Mills-Packard and Gaillard-Parrish systems.

Fig. 2 shows a Gaillard-Parrish tower chamber in course of erection. Tower chambers can be built of varying dimensions. That shown is 22 ft. 6 in. diameter by 45 ft. high. Such a tower chamber is too large in diameter to admit of a wooden drum being used for its construction. Neither can a table

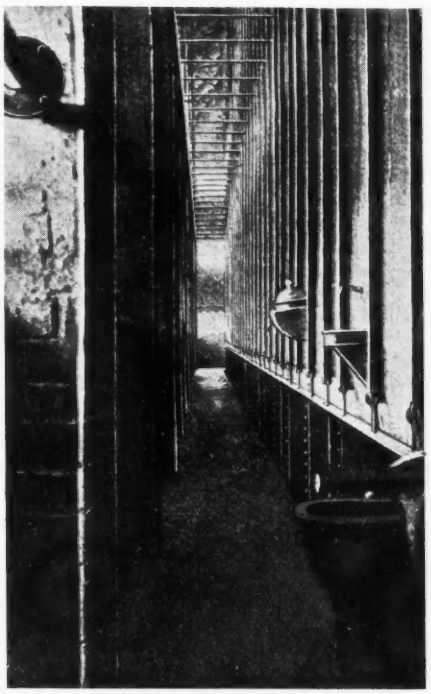


Fig. 1.—A marked advance in the construction of sulphuric acid chambers.

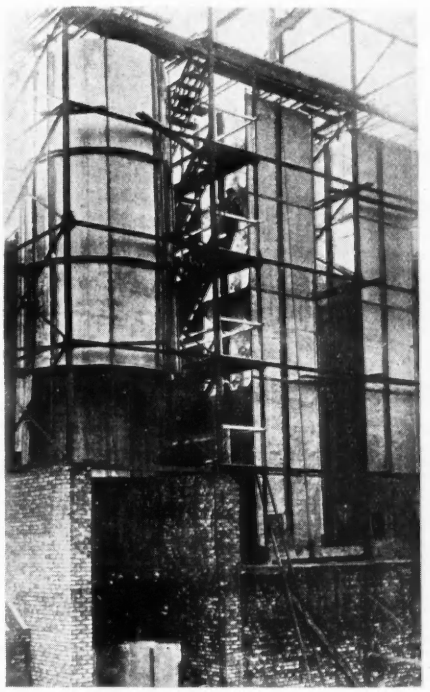


Fig. 2.—Bolting up straps at various heights of the structure.

readily be employed, because it cannot be accommodated within the enclosure of the steel skeleton framework. Construction, however, is not difficult. It is necessary to use nine sheets of lead, about 8 ft. 3 in. wide, of the required length (making due allowance for the lap for burning), to cover the circumferential sides of such a tower chamber. If sheets were rolled up to 10 or 12 ft. wide, naturally, a lesser number of sheets would need to be lifted, and there would be less vertical burning. These factors would certainly facilitate erection. This is one of the directions in which chemical lead manufacturers can assist acid manufacturers, by providing chemical lead in widths of 10 ft. or more.

Fig. 3.—Half Drum in position ready to be hauled.

The vertical straps are burnt to the sheet lead on the ground, in much the same way as is necessary when constructing the chamber (Fig. 1). Subsequently, the sheet is rolled on a mandrel, then the top portion is fixed between an arc channel and a flat, which are provided with lifting eyes. The tackle is attached, and the sheet is unrolled with the straps outwards, so that they can be placed between the vertical angle and the flat, to which they are attached by bolts at about 8 in. centres. As the lead sheet is unrolled, so it assumes the curvature of the arc channel: but, of course, it is necessary for the plumbers to dress the lead a little, so as to get a really excellent formation, such as is seen in the completed chamber in the background.

Fig. 2 shows the plumbers bolting up the straps at various heights of the structure, and the arc channel attached to the block and tackle, and the revolving steel beam from which the lifting is effected are all visible.

Where Glover and Gay Lussac towers are of circular construction, and of lesser dimensions than the tower chambers, it is usual to use either a drum or a half-drum, according to the size of the tower. Where a drum is used, the sheet is rolled out on a platform on the ground, and continuous straps are burnt on; the lead is coiled from either end, lifted to the drum, and allowed to fall in order to assume the shape of the drum. Such sheet is also attached temporarily to such drum. The seam is burnt, the drum is turned on its side, and is lifted into a vertical position, ready to haul it and put it in the framework arranged for its attachment.

To facilitate the burning of the seam, the drum is provided with a shaft and trunnions. It is usual to begin erection at the bottom, and to build up gradually to the required height. As many as five or six lifts are necessary, in the case of the larger Glover and Gay Lussac towers. The top edge of one section is flanged to the extent of about 2½ in. and the bottom edge of the section to be placed immediately above it is

flanged to about 2 in. Thus, as the lifts proceed vertically a horizontal seam has to be burnt by the chemical plumber. Usually, a supporting angle is placed underneath the respective flanges, so as to give adequate support.

The use of a half-drum, actually in position ready to be hauled, is shown in Fig. 3. When a half-drum is used, it is usual to start erection from the bottom on one side and work upwards, and then to work downwards on the next semi-circular portion. Thus, the final lift is at the bottom, as is seen in Fig. 3.

Tower chambers of the Gaillard-Parrish system are usually constructed throughout of soft chemical lead, of 7 or 8 lb. per sq. ft. : Glover towers of 16 lb. per sq. ft., with a dish of 60 lb. per sq. ft., and Gay Lussac towers of 10 lb. per sq. ft., with a dish of 18 lb. per sq. ft.

Oxy-hydrogen, oxy-acetylene and oxy-coal gas can be used with advantage for autogenous soldering of chemical lead sheets. In some of the large installations of sulphuric acid plant in London, manufacturing 700 tons per week, a permanent supply of coal gas is laid in the gangways of the plant. Thus, there is a ready supply "on tap." In smaller sulphuric acid factories, the portable plumbers' sets, using oxy-acetylene, as supplied by the British Oxygen Co., Ltd., are being increasingly used, and can be recommended with every confidence.

Within the limits of an article of this kind, it is impossible to deal with all aspects of the construction of sulphuric acid chambers, indeed, a book would be required to treat the subject adequately. What can be emphasised is the necessity for skilled riggers, to work in conjunction with skilled chemical plumbers. Safety-first devices should be adopted at all points of the structure. A definite technique has been established in the trade, and is well known to those who have had occasion, as the writer has, in the course of his experience, to be responsible for the erection of as many as ten new sulphuric acid plants in one year.

Homogeneous Lead Linings

By W. THOMPSON, M.I.Chem.E., M.I.Weld.Eng.

NO review of the uses of lead in the chemical and allied trades would be complete without reference to homogeneous lead lining and coating.

Sheet lead lining on vertical surfaces, or on the underside of covers and the like, requires supporting at frequent intervals. This is usually done by "plugging" the vessel at frequent points and burning the sheets to these plugs; or by inserting mild steel supporting strips, rings, etc., which are, in turn, covered with sheet lead, and all seams "burnt up" in the usual manner. Whilst these methods have been used in the past, they have many inherent defects.

Nearly all chemical processes involve variations of temperature, either due to reaction or added heat, complicated in some cases by alternate cooling; likewise the vessels generally work under varying pressures, either above or below atmospheric pressure. Due to these conditions, sagging and creeping of the lead almost invariably takes place, especially in large vessels. This "creeping" sets up strains in the lead, which, not being particularly strong in the first place, sooner or later becomes ruptured, and the contents of the vessel penetrate behind the lining, often with disastrous results, either to plant or product.

An effort was made to overcome these troubles by tinning the surface of the vessels, and whilst the tin was still semi-molten attaching strips of sheet lead, then burning up the seams between the strips in the ordinary way. This was often, and in some quarters is to the present day, misnamed "homogeneous." Actually, although a great improvement on ordinary sheet lining, this process was not very successful under vacuum or heat, and furthermore, when the burnt seams or the sheet lead became punctured, the acids attacked the tinning and rapidly crept between the sheet lead and the mild steel body.

To be really homogeneous, sheet lead should *not* be used at all, and material should be worked up direct from "the pig." For the highest quality of work tin should not be used for attachment purposes, as it is liable to float to the surface, either distributed or localised, during application of the lining; and under working conditions forms nuclei for attack, as well as being subject to rapid deterioration should the acids pierce through to the tinning.

During their seventeen years' experience in this work, John Thompson (Dudley), Ltd., have evolved their own process for avoiding all these snags, and all their work is guaranteed to be really homogeneous. By the term "really homogeneous" is meant that it is impossible, with a hammer and chisel, to chip or prize away the lead from the mild steel plate without leaving either some lead attached to the steel, or bringing away a chipping of steel with the lead. These coatings and linings will withstand pressure or vacuum, heat or cold (within limits, of course), can and have been applied to one or both sides of mild steel plates, also to cast steel, brass, copper, monel metal and cast iron. It will, of course, be appreciated that in the case of cast iron or cast steel, only the best quality material should be used, and the design should be such as to avoid residual stresses in the metal after casting and cooling, also the adhesion of the lead is to some extent dependent on the quality of the casting.

As well as being applicable to the inside of tanks covering a wide range of sizes, these coatings can be applied to the outside of shafts, agitators, coils, etc. By an adaptation of this same process the inside of pipes can be homogeneously coated with equal success. These homogeneously lined pipes should not be confused with similar steel products which consist of lead pipes drawn into a mild steel tube.

For most processes, very pure lead gives best results, and these coatings can be supplied so pure that chippings actually taken off the work will give much better results than the flash test of 300° C. called for under the highest class of British Standard Specification 334, proving that the lead is not contaminated by the homogeneous process.

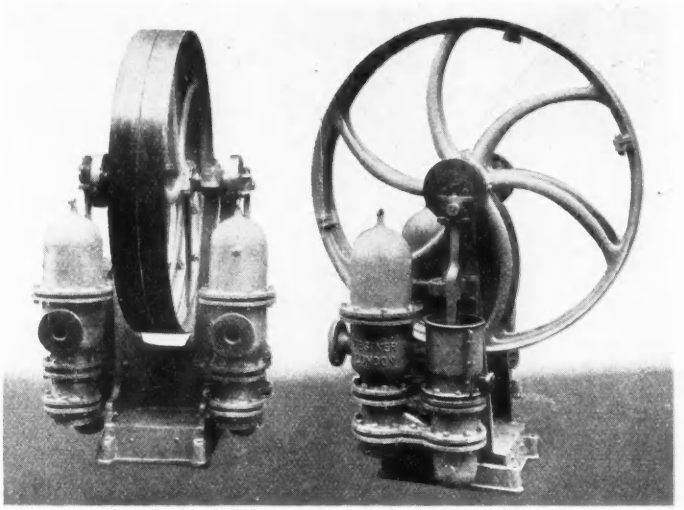
Where the vessels have to withstand considerable vibration and alternating stresses, the pure lead, due to its inherent softness, is liable to develop intercrystalline cracks, and for these conditions antimonial lead alloys are recommended. These alloys are also recommended for certain acids other than sulphuric, and for use where the lead is liable to erosion or abrasion due to the necessity of scraping certain products off the surface of the lead during the working life of the plant. Antimonial lead is also used for the construction of acid-resisting valves, bearing bushes, and other machined parts.

Another of the "improved lead alloys" recently developed is the tellurium lead aloy. This is, of course, available as sheet and pipe, but can also be homogeneously applied. John Thompson (Dudley), Ltd., hold the exclusive licence for the homogeneous application of these tellurium alloys.

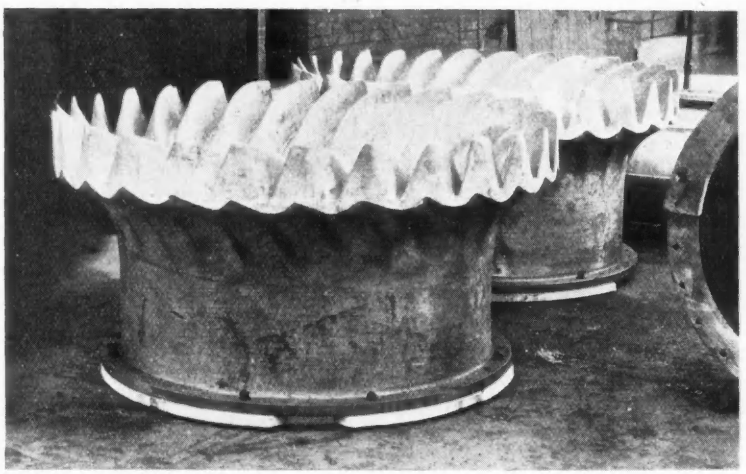
A NEW development has taken place at Trail, B.C., where the Consolidated Mining and Smelting Co. perfected a process for making elemental sulphur. A recent announcement stated that the construction of a plant to produce 54 tons of sulphur daily has been authorised. Canada's imports of sulphur have been in the neighbourhood of 15,000 tons annually, practically all from the United States.

British Chemical Engineering Progress as illustrated by the Use of Lead

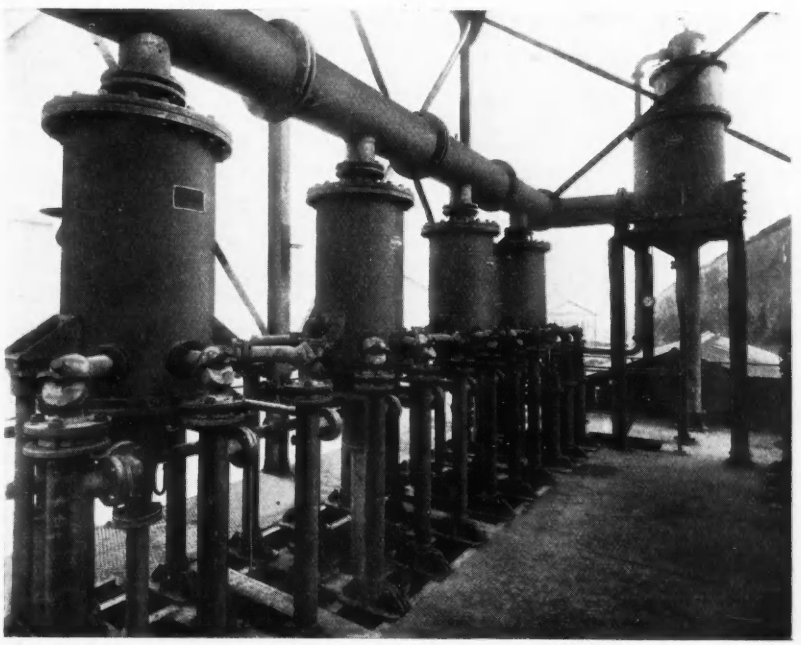
Sheet Lead
Homogeneous Lead Lining
Antimonial Lead



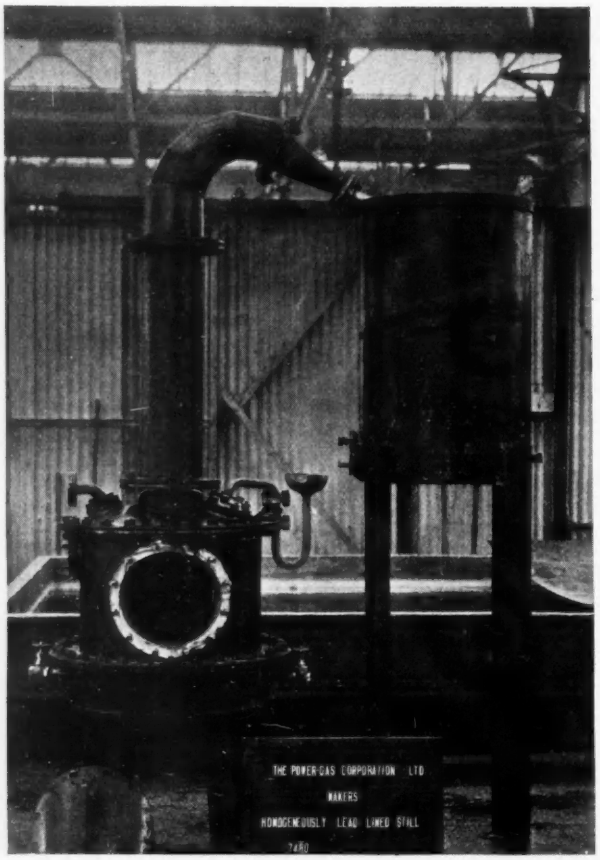
Double plunger glandless pumps are widely used for feeding acid towers. The body parts of this pump are homogeneously lead lined. The mechanical efficiency of these pumps is extremely high, being approximately 80% and they are built for heads up to 100 feet. An interesting feature is that pumps of this type can be used successfully for pumping acid directly to sprays. (Kestner Evaporator and Engineering Co., Ltd.)



Solid antimonial lead has found a useful application in these distributor pipes, which are subjected to severe working conditions. (Power Gas Corporation, Ltd.)

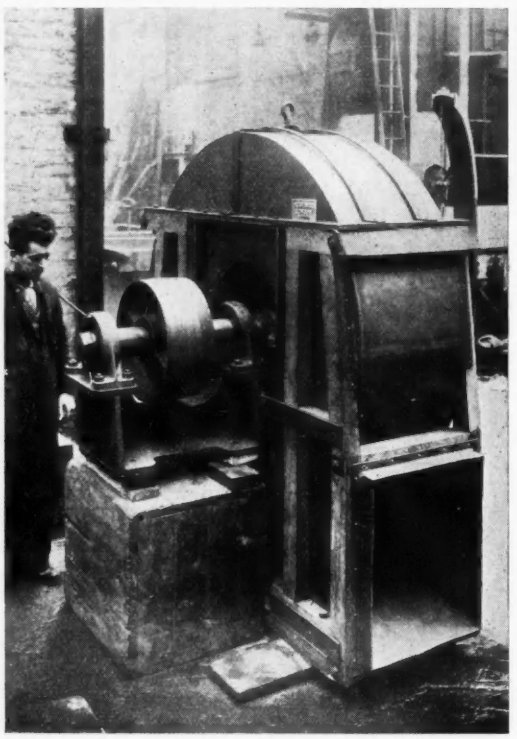


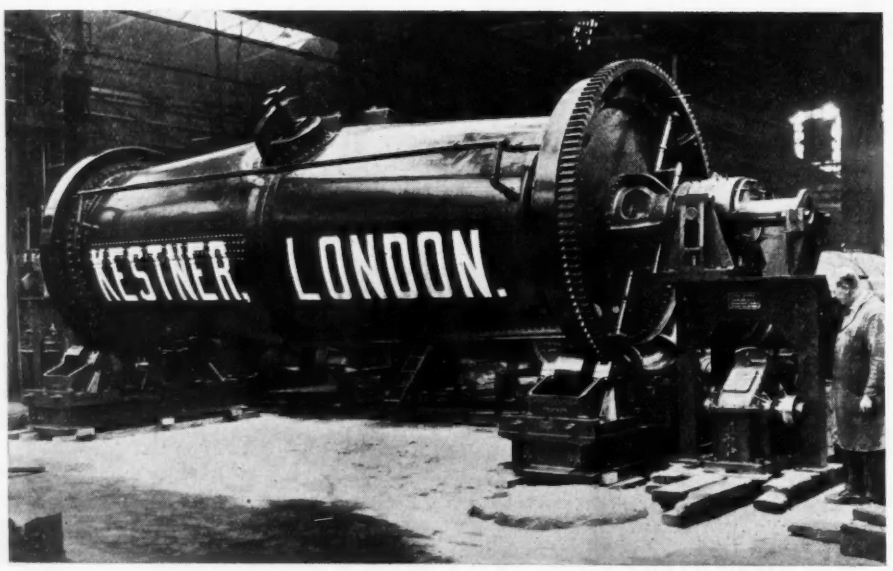
Operating on the well-known climbing film principle, this patent acid evaporator is widely used for the concentration of sulphuric acid and liquors with free sulphuric acid. Installations are in operation in the artificial silk industry, for the recovery of spinning bath liquor, and in the paper trade for the reconcentration of sulphuric acid in parchment paper making. The tubes are made in special lead alloy and the separators, vapour pipes, etc., are steel, homogeneously lead lined—the whole of the contact being lead throughout. The photograph, taken from the top platform, shows the separators, vapour pipes and tops of the calandrias. (Kestner Evaporator and Engineering Co., Ltd.)



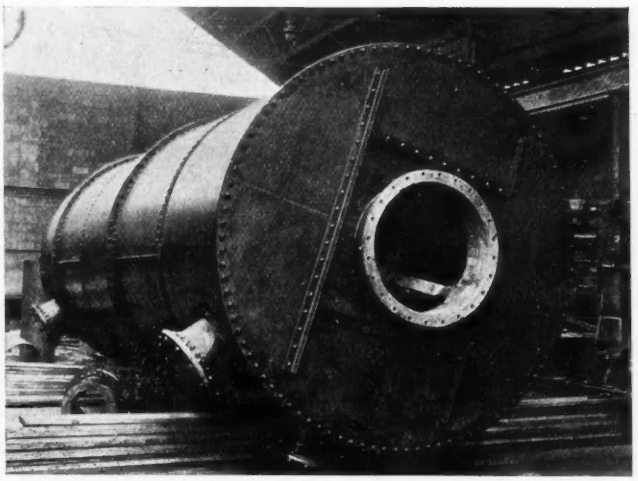
This small distillation plant, comprising steam heated still, short fractionating column, and condensing coil in tank, is constructed of mild steel homogeneously lead lined to prevent corrosion by the liquid under treatment. (Power Gas Corporation, Ltd.)

A lead casing and homogeneously lead covered impeller is provided for this large low pressure fan, which handles acid gases. Fans of this construction are used for hot SO_2 gases, but similar fans with impellers in special lead alloy are made for cool gases. Lead contact fans are made for pressures up to about 10 inches water gauge, or even higher. (Kestner Evaporator and Engineering Co., Ltd.)



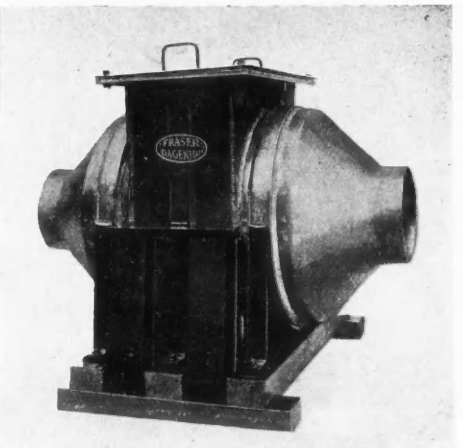


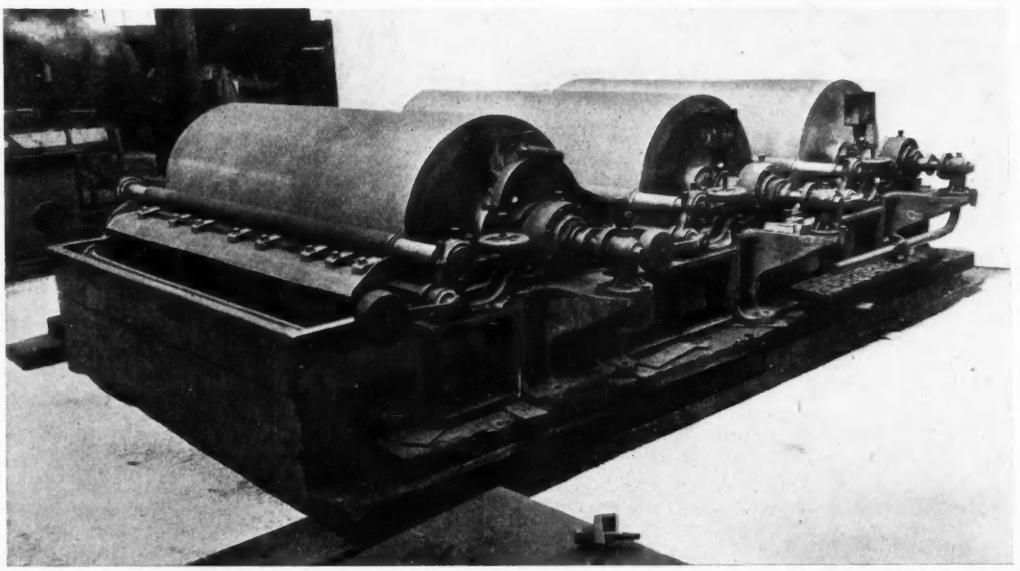
This is one of a battery of large rotary digesters which are homogeneously lead lined throughout and which are steam jacketed. The working pressure in the jacket is 75 lb. per sq. inch, corresponding to a temperature of 160° C., and in operation the interior of the autoclave is submitted alternately to 90 lb. pressure per sq. inch, and 28 inches vacuum. (Kestner Evaporator and Engineering Co., Ltd.)



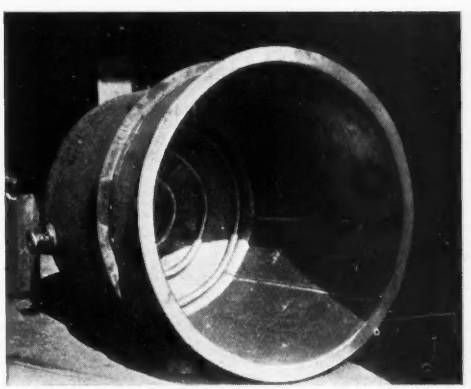
One of a number of acid scrubbing towers 10 ft. in diameter and homogeneously lead lined internally, the outer shell being constructed of mild steel. These towers are packed with porcelain rings and are provided with acid distribution equipment to thoroughly scrub the gases. (W. J. Fraser and Co., Ltd.)

This special gas scrubbing equipment was supplied for use with sulphuric acid concentration plant. It is constructed of chemical sheet lead provided with mild steel supports and bracings. The interior is fitted with baffles to remove the liquid carrying the gas. (W. J. Fraser and Co., Ltd.)

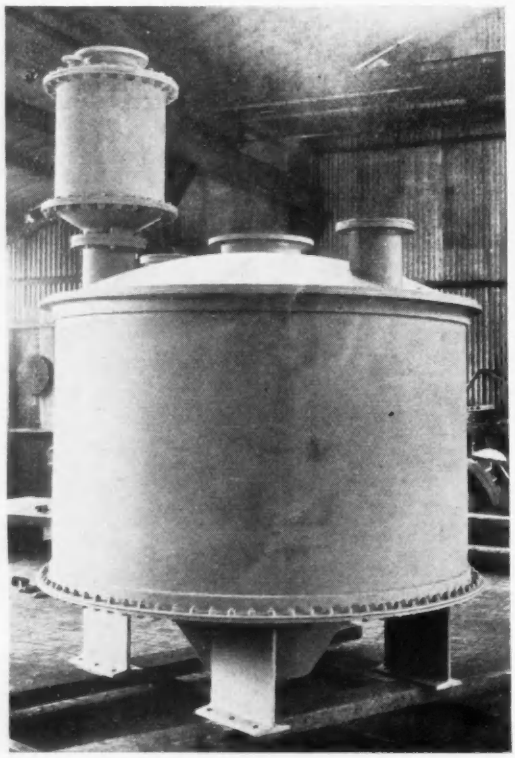




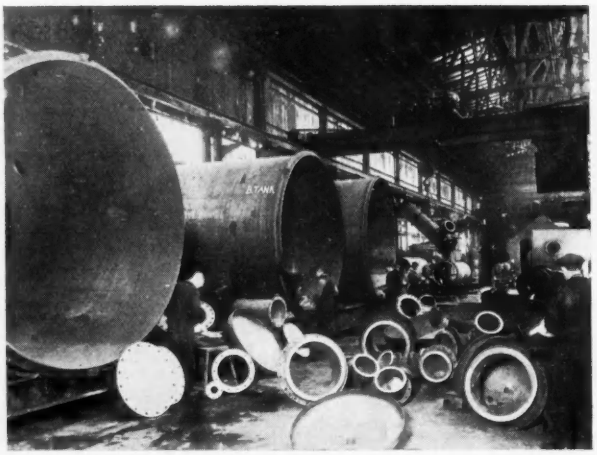
These patent rotary drum film crystallisers are also used for the cooling of corrosive liquids. The drums are homogeneously lead covered and the troughs, through which the liquid to be cooled is passed, are lead lined. The machine is either water-cooled or brine-cooled, depending on the working temperature required. Continuous operation is obtained, the warm feed being supplied at one end, and the cooled liquor discharged with the crystals at the other end. A special device is fitted which enables crystals and liquor to be removed from the surface of the drums without damaging the lead covering. (Kestner Evaporator and Engineering Co., Ltd.)



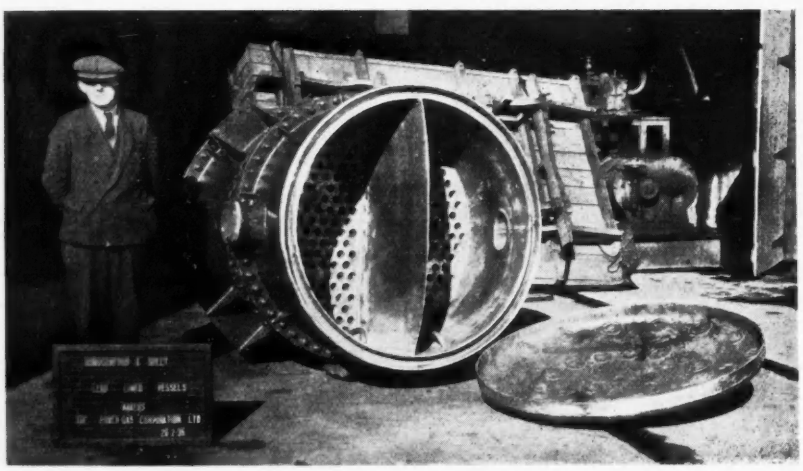
Used for washing kerosene with acid or alkali, this vessel is heated by means of a lead coil at the bottom, and the walls of the vessel are lined with lead homogeneously attached. (W. J. Fraser and Co., Ltd.)



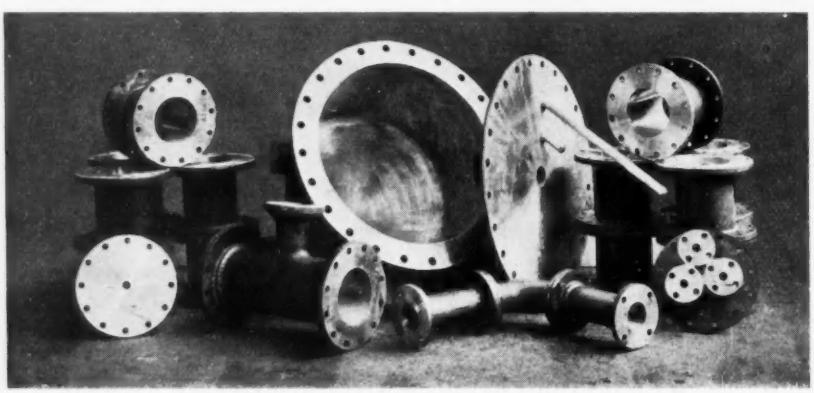
Made in mild steel, this 10-ton per day sulphate of ammonia saturator is homogeneously lead lined inside to a thickness of $\frac{1}{2}$ inch. (R. Marsh and Co.)



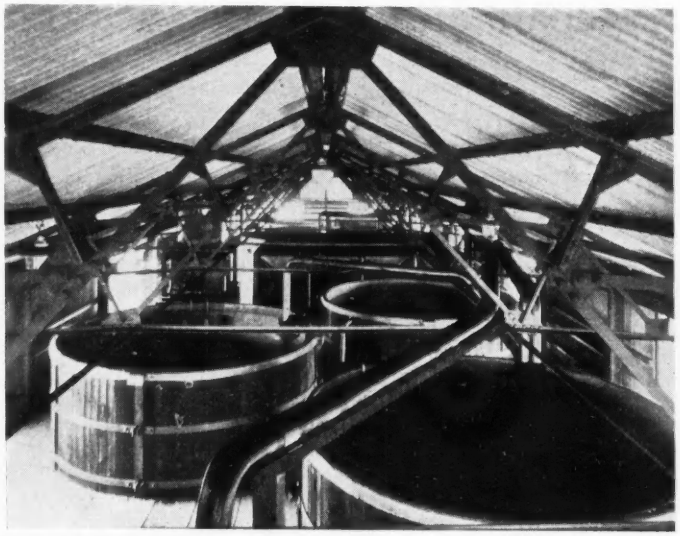
Part of the homogeneous lead lining department at the works of John Thompson (Dudley), Ltd. Two men on the right are "burning up" agitators; pipes from 3 in. to 3 ft. diameter and crowned ends are in process of being lead lined. In the foreground are shown sections of tanks, which, when completed, will be 10 ft. diameter × 40 ft. long, the largest homogeneously lead-lined tanks which have ever been made in this country, or possibly in the world.



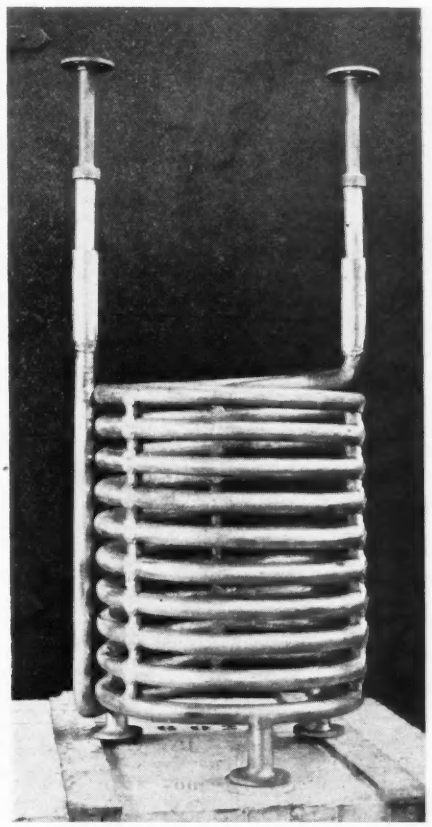
Homogeneous lead lining and also sheet lead were used in the construction of this condenser type air cooler. (Power Gas Corporation, Ltd.)



Unassembled parts of an experimental still, scrubbing column, thermometer pockets, etc., made for a well-known firm of chemical manufacturers and homogeneously lead lined: a typical example of some of the smaller articles to which lead lining can be applied. (John Thompson, Dudley, Ltd.)

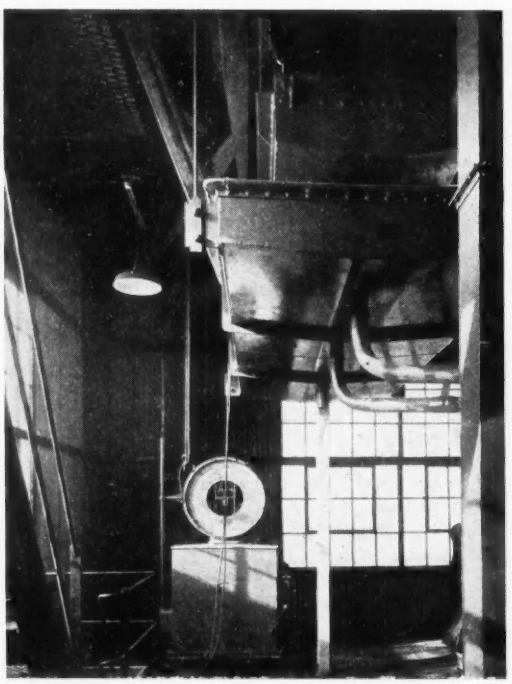


Sheet lead is used for lining these sulphuric acid storage tanks at a modern fertiliser works. (Mills Packard Construction Co., Ltd.)

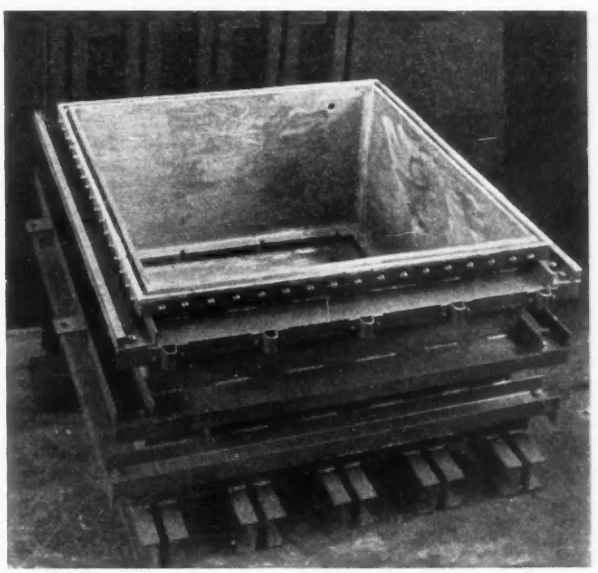


A typical mild steel coil, homogeneously lead coated, for use in heating acid liquors by high-pressure steam; piping made wholly of lead suffered badly due to steam erosion and comparative lack of strength. (John Thompson, Dudley, Ltd.)

Lead has many uses in Chemical Engineering



This weigh tank for sulphuric acid is lead lined and is complete with Avery dial scale. (Mills Packard Construction Co., Ltd.)



This is one of several repeat orders for filter casings, which, due to the nature of the product, had to be coated with 6% antimonial lead alloy. Intricate work around the rim and the bottom edges of this tank will be noticed. (John Thompson, Dudley, Ltd.)

"Lead Burning" in the Repair and Maintenance of Chemical Plant

By E. B. PARTINGTON

LEAD BURNING (lead welding) has of necessity to be used very extensively in the repair and maintenance of chemical plants owing to the fact that both sheet and lead pipes are used in large quantities for chemical plant construction. Plumbers' solder, moreover, is not satisfactory for jointing lead that is to be used for either the conveyance or storage of acids owing to the tin in the solder being readily attacked and joints made porous, and due to this it is necessary to make all connections between two or more pieces of lead by "lead burning."

Before proceeding to explain the many applications of repairs in chemical works it will be of interest to have a knowledge of the different types or systems of flame lead-burning that are available for the chemical plumber. Briefly they are:—

Gas System.	Flame Temp.
Generated Hydrogen—Atmospheric Air ..	Approx. 1700° C.
Coal Gas—Oxygen	Approx. 2000° C.
Hydrogen (Compressed)—Oxygen ..	Approx. 2400° C.
Acetylene (compressed)—Oxygen.. ..	Approx. 3600° C.

The first-named system is now being rapidly displaced by the other methods, due to the fact that they possess many advantages from both a portability and cleanliness point of view. When the oxy-acetylene system was first introduced it was thought that the temperature of the flame would be far too hot for the welding of lead. Experience has, however, proved that the high temperature is an asset, experiments having shown that sheet lead, even though it be as thin as 1/16th of an inch (3 lb. per foot super), can be jointed in all positions, including both underhand and overhead seams. Going to the other extreme, plate lead (30 lb. per foot super and above) can be jointed very rapidly and efficiently by this method.

Fig. 1—Carrying out repairs while plant was working

In a typical oxy-acetylene system the size of the cylinders would be oxygen 15 cubic foot capacity, acetylene 12 cubic foot capacity. The burning period of these two cylinders, assuming that 6 lb. per sq. ft. sheet lead is being jointed, is approximately 12 continuous hours. Where coal gas is laid on in pipe lines in works, the oxy-coal gas system can be used very economically, and will be found satisfactory for all types of work. The speed of welding is, however, not so swift as the oxy-acetylene system, and the oxygen consumption is greater.

Preparation of Lead and Lead Burning

Repairs and renewals to leadwork in chemical works have to be executed under all kinds of conditions. Very often it is necessary to have to carry out a quick repair whilst the plant is working, as in chamber repairs (see Fig. 1). Here the temperature of the lead may be between 70° to 110° C. To repair a defect on the side of a chamber under these conditions the operator must be skilled in the art of lead-burning, otherwise he will soon realise that the lead falls away or collapses before he has time to fuse it.

In executing a repair of this character, the first thing to be done is to see that the surface of the lead is thoroughly cleaned, and all oxides, sulphates, or foreign matter removed. A very useful substance to have handy is "dry powdered lime." This should be rubbed over the part to be welded with a piece of coarse sacking. The effect of the lime is two-fold, firstly to neutralise any acid that may be about, and secondly to scour the lead and give it a bright metallic surface.

Just a word of warning, however, before attempting to commence the lead burning. Owing to the corrosive action on the lead taking place from the inside of the chamber, the defect is not noticeable from the outside until the sheet lead is very thin, and pinholes appear on the outer surface. This means that the lead to be fused with the flame is very weak, and only equivalent to 3 lb. per foot super in places. Bearing this in mind, when fitting the lead patch on to it, the lead need not be more than 5 lb. per foot super, otherwise the difficulty of having to weld thick lead to very thin presents itself.

In lead burning a patch on the vertical sides of a chamber, and assuming that the lead edges have been thoroughly cleaned, the first thing to be done is to produce a small "sharp" flame at the blowpipe tip. This is projected on to the lead as shown in Fig. 1, and the underhand seam is fused as quickly as possible. The underhand seam is lead-burned first for the reason that the longer the flame is projected on to the lead it expands and opens the fracture, thus allowing any acid in the vicinity to trickle in between the two surfaces of lead and make the fusion very difficult. The secret of making a satisfactory weld in this particular instance lies in the flame setting. It is vital that a very small sharp flame be produced, and not a large "soft" flame, as is often the case with the beginner.

Repairs to Tanks and Vats

The repairing of tanks and vats form a large part of the chemical plumber's activities. These vary very considerably in size and shape. Unlike chamber work the corrosive action of the acid upon the lead is visible each time the container

is emptied. This enables the chemical plumber to effect a necessary repair before the lead gets too thin, so that the difficulties mentioned in chamber repairs are obviated. Here, however, he meets with diffierent conditions. Due to the expansion and contraction of the lead brought about by fiuctuations in temperature, the lead very often creeps and stretches at various points. This continues until a fracture occurs. Or, as very often happens in lead-lined iron vessels used for mixing acids, etc., the lead is punctured, either by a mechanical defect during working, or by excessive friction of the acids during the mixing process.

With the former (lead-lined tanks) the majority of these are constructed of stout timber casings, with the result that a defect or leak in the leadwork very soon shows itself on the outside. But with the latter (iron vessels and vats) a defect does not show itself so readily, owing to the ironwork being made water- and acid-tight during construction, unless it is emptied fairly frequently. This means that the lead lining, if left unsuspected, bulges and comes away from the iron shell, and allows acids and foreign matter to get in between the iron and the lead casing.

To effect a satisfactory repair in a wooden tank, it is first of all necessary to clean the tank out thoroughly with either water or steam to get rid of all traces of acid. The lead in the vicinity of the fracture is then cleaned, as previously stated, by using powdered lime. Should the fracture be on the vertical sides of the tank, it is necessary to fit a new piece of lead over it.

There are several methods of fitting a piece of lead to produce an efficient repair. To obviate difficult lead burning some chemical plumbers fit a patch as shown in Fig. 2. This method does away with both vertical and underhand work, and makes a very simple proposition regarding the lead-burning. On the other hand, highly skilled lead burners prefer to fit a rectangular patch as shown in Fig. 3. When the latter method is adopted, the main point to watch is that the lead burning is not " cut in " at any point. This usually occurs at the edge of the weld on the overlapping portion (Fig. 4), and weakens the joint considerably. A strong joint should appear as shown by " B " (Fig. 4), from which it will readily be seen that the joint is the strongest point.

Where the defect is in the bottom of the tank, the plumber can either cut the fractured portion clean out and insert a new piece with the edges abutting, or he can lay a piece of sheet lead over the fracture and fuse same to the base metal.

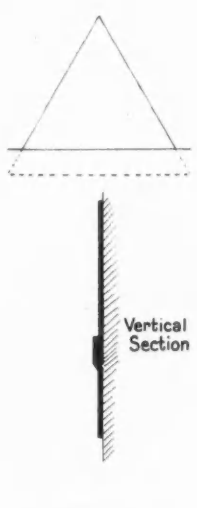


Fig. 2.

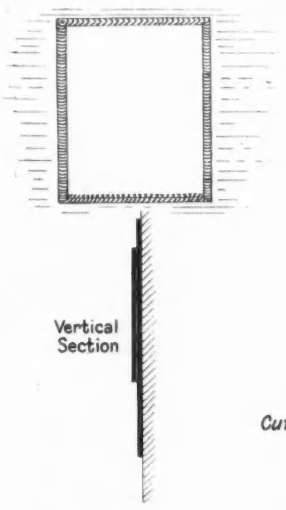


Fig. 3.

Fig. 4.

The former method is to be preferred, as it enables thorough penetration of the two pieces of lead when welding, and also keeps the lead patch flush with the remaining portion of the bottom of the tank. But as time is very often the important factor, the latter method is very often adopted for speed.

Fig. 5. A repair job in which portability of plant is a main feature.

Before commencing to repair a fracture in a lead-lined iron vessel, the lead should be cut in the form of a cross and the four corners turned outwards to enable any foreign matter that may have accumulated being removed from between the lead and the iron. When this has been done the lead is carefully dressed back to the iron shell and the repair carried out in exactly the same manner as would apply to a wooden tank. Owing to the heat conductivity of the iron it will be found necessary to use a slightly larger flame than would be used when executing a fusion weld where there is a wooden casing.

Another type of repair in chemical works is shown in Fig. 5. In this instance portability of plant is a main feature, owing to it being common practice to have to carry out a repair in most awkward and high places. To ease the situation and prevent having to run long pipe lines to convey the gases small cylinders are introduced as shown. This enables the oprator to have full control of the gases at his hand, and obviates having large quantities of gases in long lengths of tubing or pipes.

The volume of gases consumed by the blowpipe flame in the various systems are as follows :—

Gas System.	Gas Consumption.
Generated Hydrogen—Atmospheric Air ..	2-3 vol. hydrogen to 1 vol. of air.
Oxygen—Coal Gas	1-2 vol. of coal gas to 2 vol. of oxygen.
Oxygen—Hydrogen (compressed) ..	3 vol. hydrogen to 1 vol. of oxygen.
Oxygen—Acetylene (compressed) ..	1 vol. acetylene to 1 vol. oxygen.

Although lead burners vary slightly in the particular type of flame that they themselves prefer, the foregoing can be taken as a general guide.

New Technical Books

JOLY'S "TECHNICAL INFORMATION FOR 1936" (Technisches Auskunftsbuch für das Jahr 1936). 41st Annual Edition. Joly Auskunftsbuch Verlag, Kleinwittenberg a. E. (Germany). RM 16.50.

A year ago we reviewed the fortieth edition of Joly's Technical Information and gave an appreciation of the advantages of the book. The forty-first edition follows its predecessors worthily. The information in the book is good and to be recommended, as well as being up to date with regard to all technical changes during the past year.

* * *

PROCESSES OF THE INORGANIC-CHEMICAL INDUSTRY (Die Verfahren der anorganisch-chemischen Industrie). By Dr. W. Siegel. Urban and Schwarzenberg, Berlin and Vienna, 1935.

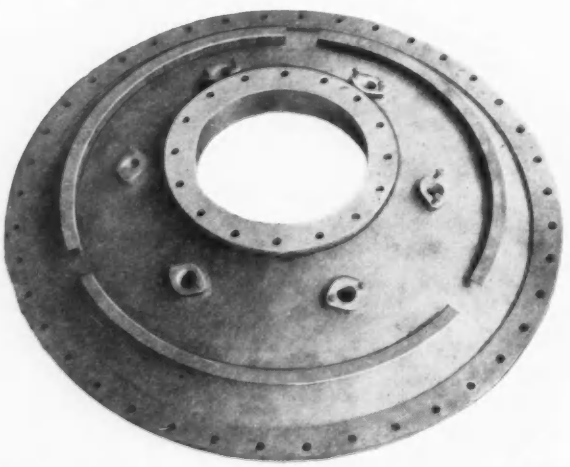
Dr. Siegel's book, "Processes of the Inorganic-Chemical Industry," appears as Vol. I (1934) of the "Annual Reports of the Patents and Technical Literature of Industrial Countries." The title, "Annual Reports," is much too modest for the great importance of even this first volume of "Reports on the Progress of the Inorganic Chemical Industry." A short but detailed account must be given in order to describe it. When, twenty years ago, the first edition of Ullmann's "Encyclopaedia of Technical Chemistry" appeared (also published by Urban and Schwarzenberg), it created the greatest sensation in the chemical industry of the whole world that a technical work had ever done; there was no chemical factory, big or little, that had not to possess these twelve volumes. That such a work of this extent should appear after about 10 years in a second edition shows its importance and the uninterrupted further development of the chemical industry. As no other industry, the chemical trades are dependent on "progress" and "development." To know the changes necessitated in the chemical industry is of special and frequently decisive importance for the chemist. We cannot, however, wait until the third edition of Ullman appears; we must know at once what is taking place. Dr. Siegel's book can be considered as a continuation of Ullmann's Encyclopaedia. He gives an excellent survey of technical progress in the inorganic chemical industry from the patents of America, Austria, Belgium, Canada, Czechoslovakia, England, France, Germany, Holland, Norway, Poland, Russia, Sweden and Switzerland. The book possesses what is specially important for a work of reference—outstanding clearness of arrangement. The first look at the table of contents shows an enormous abundance of matter. Each chapter begins with a list of literature, each sub-division is as expert as it is self-contained. Nevertheless, whoever looks through the index will find what numerous sequences there are through the whole book; they show that the chemical industry can, and must, only be looked upon to-day, in spite of so many different branches, as a complete whole. The aim of Dr. Siegel's book is to serve this "whole" of the chemical industry, and its very widest circulation in every field of the industry is to be hoped for.

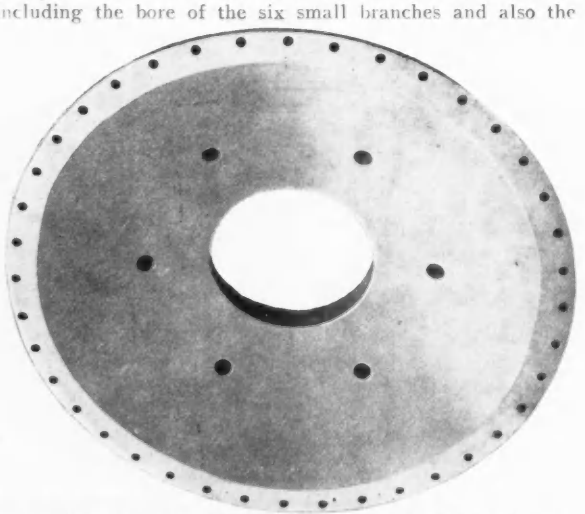
* * *

THE CHEMICAL ENGINEER (Der Chemie-Ingenieur). By A. Eucken and M. Jakob. Akademische Verlagsgeselschaft m.b.H., Leipzig.

Eucken and Jakob give this work the sub-title, "A Handbook of Physical Working Methods in the Chemical and Allied Industries." They show thus their intention; their success is, however, greater. Physics have lately proved themselves to be fundamental for chemistry in two respects, in theory and practice. Theoretical physics can to-day interpret thoroughly the intramolecular relations and proceses which were formerly reserved for chemistry. In practice, recognition is growing that working methods in chemistry are almost exclusively physical ones. Eucken and Jakob's book is for the arrangement and description of these physical working methods in chemical factories. The fundamental idea is that when all that happens in the industry is really physically established, a classification according to physical principles must be possible and suitable. Therefore, single operations are summarised, theoretically based and so systematically grasped that their study must serve the application of this operation in all chemical and allied industries. A survey is thereby given from a high eminence of relationship which has never been the case in text books of chemical technology from the same standpoint. This book is therefore a welcome supplement to present excellent works on chemical technology from the point of view of practical physics on theoretical principles.

HOMOGENEOUS lead coating and lead lining work is carried out by the Oxley Engineering Co., Ltd., at Leeds, where they have workshops fully equipped on modern lines for such work. The above illustrations show internal and external views of a mild steel cover 6 ft. 6½ in. diameter, homogeneously lead coated. The vessel for which this cover was required was subject to high vacuum under working conditions, and it was essential that the whole of the surfaces including the bore of the six small branches and also the centre branch were perfectly homogeneous. With the process of lead coating adopted, which consisted of all lead being laid with the blow-pipe, perfect homogeneity was obtained.





The British Association of Chemists

Annual Meeting of the London Section

THE 18th annual general meeting of the London Section of the British Association of Chemists was held at the Broad Street Station Restaurant, London, on May 1, Mr. G. T. Gurr presiding.

Miss WRIGHT, hon. secretary, reported on the work of the year and pointed out that the membership had increased from 618 full members to 663, and the total, including probationers and students, was 865. After making allowance for transfers there was a net increase of 37 for the year. It was also pointed out that the special aid fund had dealt with a number of emergency calls during the year, and members were asked to give further support to this fund, however small their contributions. The accounts showed a substantial balance in hand.

The following officers were elected: Chairman, G. T. Gurr; hon. secretary, Miss W. Wright; hon. treasurer, Captain R. P. Porter; council, A. J. Baker, W. E. Callingham, J. Vargas Eyre, J. P. Lawrie, W. C. Peck, E. A. Rayner and T. I. Woods.

Mr. C. B. WOODLEY, general secretary, reporting on the activities of the appointments bureau and the legal air fund, said the improvement in employment during the past 12 months had been most impressive. The present position showed a demand for experienced chemists, and the result was that salaries offered were on a rising scale. More and more employers were coming to the association for experienced chemists, and the appointments filled during the year carried substantial salaries suitable to the qualifications and experience required. Salaries had ranged from £275 per annum for honours graduates without works experience to £1,000 and £1,500 per annum for appointments requiring exceptional experience and skill. In addition, a number of junior appointments had been filled by probationer and student members at quite attractive salaries. Conditions were always changing, new substances were being produced, and new methods of manufacture must be found to meet the public demand which was constantly changing. Such conditions required a chemist of ability and experience, alert to take advantage of and cope with all these variations, maintaining the high standard of his products, and, where possible, lowering the cost of production. Happily, the majority of employers recognised that the success of their business depended on the ability and success of their chemist, and the progressive employer offered substantial rewards for services which made his business successful.

Mr. C. S. GARLAND, chairman of council, spoke of the efforts made by the council not only to improve the conditions so far as members were concerned, but the conditions of the profession as a whole. He expressed the view that a great opportunity had been lost when considering recent legislation, because others were not willing to act in the interests of the profession as the association did.

Personal Notes

MR. J. RAMSAY MACDONALD, Lord President of the Council, will, it is hoped, open the British Chemical Plant Exhibition at the Central Hall, Westminster, at 11 a.m. on June 22.

SIR PHILIP NASH, vice-chairman of Associated Portland Cement Manufacturers and British Portland Cement Manufacturers, died in London on May 1, aged 61.

MR. ROSS GEMMELL, of Quarryside, Whaley Bridge, died last week at the age of 68. With Mr. S. B. Brown he was responsible for planning one of the original branches of the Calico Printers' Association.

LORD RUTHERFORD has promised to deliver the twelfth annual Norman Lockyer Lecture of the British Science Guild on November 12 at the Goldsmiths' Hall, Foster Lane, E.C.2 (by courtesy of the Goldsmiths' Company).

MR. DONALD DANIEL MCRAE, of Broompark, Denny, Stirlingshire, late managing director of Robert Benny and Co., Ltd., manufacturing chemists, who died in January, left estate valued at £8,905.

MR. COLIN H. CAMPBELL, a member of the staff of the Scottish Milk Marketing Board, has been appointed bacteriologist of the milk department of the S.C.W.S. in succession to Mr. Andrew McBride, who takes over the managership of the department next Monday.

MR. J. ARTHUR REAVELL has been ordered a prolonged rest by his medical advisers. It is a matter of profound regret to him, as it will be to his many friends in the chemical industry, that this will prevent his participation in any of the events associated with next month's Chemical Engineering Congress and British Chemical Plant Exhibition.

MR. C. C. PATERSON, director of the research laboratories of the General Electric Co., Ltd., Wembley, delivered the twenty-sixth May Lecture before the Institute of Metals on Wednesday. The president of the Institute of Metals, Mr. W. R. Barclay, was in the chair. The lecturer traced the effect which the liberation of the electron from metals has had on the trend of electrical engineering during the past 29 years. Experimental demonstrations with valves, photocells, electric discharge lamps and other electronic devices were used to exemplify the theme.

COL. JOHN WILLIAM SLATER, C.M.G., Holmes, Bolton, Lancashire, a director of the Bleachers' Association, who died in February, aged 68 years, left £8,313, with net personalty £4,715.

DR. CLARENCE SMITH will deliver a lecture before the Chemical Society on "Modern Chemical Nomenclature" next Thursday at 8 p.m. in the meeting hall of the Institution of Mechanical Engineers, Storey's Gate.

MR. NORMAN D. ROBINSON, who was for some years associated with the Milroy Chemical Co., Ltd., Glasgow, engaged in the manufacture and sale of bakers' materials, is president-elect of the Scottish Association of Master Bakers.

PROFESSOR R. ROBINSON, F.R.S., will deliver the fifth Pedlar Lecture, entitled "Synthesis in Biochemistry," before the Chemical Society on May 28. The lecture will be given at the Institution of Mechanical Engineers, Storey's Gate, at 5.30 p.m.

JOHN LANGLEY, the 18 year old schoolboy who put up such a fine performance last week in the amateur golf championship, is the son of Mr. F. A. Langley, chairman of Langley, London, Ltd. Although John was beaten in the final he put up a grand performance for one so young, defeating Cyril Tolley amongst other well-known players en route.

BRIGADIER-GENERAL SIR HAROLD HARTLEY, vice-president of the L.M.S. Railway Co., and SIR FRANK EDWARD SMITH, secretary of the Department of Scientific and Industrial Research and of the Royal Society, were the recipients of the honorary degree of D.Sc. of Sheffield University on May 2. SIR H. C. HAROLD CARPENTER, Professor of Metallurgy at the Royal School of Mines, received the honorary degree of Doctor of Metallurgy.

Continental Chemical Notes

Czechoslovakia

OVERPRODUCTION OF RADIUM and related products has adversely effected the profits of the Joachimstal Mines and it has therefore been decided to limit the 1936 output to 2.55 grams radium and 13,750 kilos uranium compounds.

Denmark

A REPORT HAS NOW BEEN ISSUED in connection with the experimental cultivation of the opium poppy commenced by the A.G. Kemidroga, of Copenhagen, last year. About 1½ acres of land at Jyderup on which barley had previously been grown were sown with 2 kilos of Papaver somniferum var. nigrum (imported from Hungary). Analyses (quoted in the "Chemiker-Zeitung" of April 29) revealed the surprisingly high morphine content in the dried plant of 23.8 per cent.

Germany

LATENT FINGERPRINTS CAN BE RENDERED VISIBLE, according to M. Wagenaar, of Rotterdam (quoted in the "Chemiker-Zeitung," March 25), by applying iodine to the suspected surface and then making an impression upon a specially coated white paper. The iodine can be applied by placing a petri dish containing a fused iodine crystal over the area under examination or by directing a current of air upon it from a wash bottle containing a few iodine crystals. The coating solution for the paper consists of 1 gram starch, 0.3 gram thymol and 2 grams potassium iodide dissolved in 20 c.c. water. After the imprint has been made it can be protected against injury by coating with a 3 per cent. solution of dammar resin in benzene.

AS ANNOUNCED LAST YEAR a process for producing photographs upon an oxidised aluminium surface has been developed. Writing in the "Chemiker-Zeitung," March 25, Dr. A. Jenny states that the costs of producing such photographs are scarcely higher than those of ordinary paper photographs, apart from the cost of the aluminium and the special surface treatment. Special organic developers are now available in connection with photographs on "eloxal" (*i.e.*, electrically oxidised aluminium), while the usual fixing, toning and intensifying agents are applicable. The common mercuric salts are unsatisfactory as reducing agents, copper reducing salts being preferably used in their place. Owing to the very high melting point of the oxidised surface, photographs on "eloxal" are unaffected by temperatures exceeding the melting point of aluminium itself (658° C.), thus opening up numerous possibilities in the photographic production of such articles as name plates, plans and documents.

Italy

NEW CHEMICAL PROJECTS approved by the government include: extensions to the carbon disulphide factory of S.A. Carlo de Sigis at Motta San Damiano (Pavia); plant for extraction of soya lecithin (S.A. Gaslini at Triest); extensions to the cellulose factory of S.A. Cartiere Burgo at Verzuolo (Cuneo), bringing the annual production capacity to 5,000 tons.

THE COMMITTEE APPOINTED BY THE CHEMICALS CORPORATION, last November, to advise upon the liquid fuel problem has been examining the feasibility of producing fuel from lignite, the total resources in which are estimated at 400 million tons. Sicily and Ragusa are particularly rich in lignite deposits and favourable results have already followed tests with Ragusa lignite.

ITALY'S LARGEST FIRM OF RUBBER MANUFACTURERS, Soc. Italiana Pirelli, of Milan, has installed an experimental laboratory for synthetic rubber and several of the products manufactured therefrom have already been exhibited at the Milan Samples Fair. A net profit of 29.2 million lire was achieved in the past year, a dividend of 10 per cent. again being distributed upon the share capital of 2 million lire.

Russia

ACCORDING TO GERMAN REPORTS a very considerable increase in paper production is contemplated during the present year. New factories will shortly be entering into production on the Upper Volga (yearly capacity of 17,000 tons) and in Transcaucasia (yearly capacity 11,000 tons).

Belgium

DISCUSSING THE OUTLOOK FOR SYNTHETIC FUEL MANUFACTURE in Belgium a writer in "Industrie Chimique" (April, 1936) asserts that only direct hydrogenation of coal holds out reasonable prospects of success on both economic and technical grounds.

France

ZINC WHITE IS NOW BEING MADE at Viviez (Aveyron) by the Soc. de la Vieille Montagne which is already operating zinc white factories at Levallois-Perret (Seine), and Vallentin-Cocq (Belgium).

RECENT COMPANY FORMATIONS include: Dupas and Alexandre, "Etablissements Glutor," 49 Avenue de la République, Aubervilliers (Seine), capital 500,000 francs (bakery improving agents); Le Caoutchouc Verdun, 110 Boulevard Haussmann, Paris, capital 50,000 francs (manufacture of moulded rubber goods especially for anti-gas equipment); Auxiliaire de la Chimie et de la Metallurgie A.C.M., 25 rue d'Astorg, Paris, capital 50,000 francs (trading in minerals and metallurgical residues).

COPPER SULPHATE HAS BEEN USED in the past for the preservation of wooden structures, but has not given permanently satisfactory results in spite of its powerful antiseptic action owing to its solubility in water. One of the French railway companies (writes G. Vie in "Industrie Chimique," April, 1936) is consequently now supplementing the usual injection of copper sulphate solution into woodwork by surface impregnation with creosote which, apart from its antiseptic power, retards loss of the copper sulphate during washing.

NEW MERCAPTAN DERIVATIVES (thioethers) applicable as solvents, plasticisers, dispersing agents and wax substitutes have been prepared by replacing the hydrogen atom of a mercaptan by a polyethylene glycol radicle. A yellow water-soluble liquid with high foaming power is obtained, for example, on mixing 258 parts cetyl mercaptan (obtained by reacting sodium sulphhydrate with cetyl chloride) with 10 grams sodium hydroxide, heating to 100 to 130°C. and passing in a stream of ethylene oxide gas until the weight increases by 800 grams. A wax-like product (melting at 36°C. and soluble in both water and benzene) is formed by heating a mixture of 122 parts thiodiglycol with 5 parts caustic potash to 100 to 140°C. and adding 25 molecules ethylene oxide under pressure (French Pat. 794,830).

The British Association

Blackpool Meeting Programme

THE British Association for the Advancement of Science will hold its 105th annual meeting at Blackpool during the week beginning September 9. During recent years it has been the policy of the Association to direct its activities less to abstruse and academic inquiries and more to the direct application of science to the problems of everyday life. This purpose is reflected in the preliminary programme, which has just been issued, of the main subjects for discussion in the thirteen sections through which the Association will work. Sir Josiah Stamp, in his presidential address, will deal with "The Impact of Science on Society."

The presidential address of Professor J. C. Philip to the chemistry section will be on "The Training of the Chemist for the Service of the Community."

From Week to Week

DAMAGE ESTIMATED AT £600 WAS CAUSED by fire on Monday night at the premises of Chance Brothers and Co., Ltd., Firhill Glass Works, Murano Street, Glasgow.

BONUS CUTS made by the Mond Nickel Co. at its Clydach refinery during 1932 have been restored in full. Although the Mond Nickel Co. was forced to make economies, it is noteworthy that it was able to maintain the basic wage rates at Clydach throughout the depression.

THE HOME SECRETARY PROPOSES to make an Order requiring all cases of manganese poisoning occurring in factories or workshops to be reported to inspectors of factories and certifying surgeons, in pursuance of Section 73 of the Factory and Workshop Act, 1901. A draft Order has been issued.

THE WORKPEOPLE AND STAFF of Bryant and May, Ltd., match manufacturers, visited the Bradshaw bleachworks, Bolton, of the Bleachers' Association last week on the occasion of the firm's annual May trip. A civic welcome was extended by the Mayor of Bolton (Alderman Kirkman, J.P.).

OIL PROSPECTING HAS BEEN COMMENCED by geologists of the Anglo-Iranian Oil Co., in a small area just south of the River Forth. The company is of the opinion that this shale district is more likely to yield oil in marketable quantities than any other region in central Scotland. Drilling rights in respect of about 7,000 sq. miles in Britain have been acquired by the company.

A NEW EDINBURGH INDUSTRY was launched on May 1 with the inauguration of a benzol recovery plant at the Corporation gasworks, Granton. The total production capacity of the plant is 400,000 gals. of benzol per annum, suitable for motor spirit, and it was stated that the coal consumption for the new plant would ensure permanent employment for 40 additional miners. At the present time 700 miners find employment in providing coal for the Granton gasworks.

IN THE COURT OF APPEAL on May 4, Lords Justices Slesser and Romer and Mr. Justice Finlay gave judgment dismissing the appeal of Wm. Cory and Son, Ltd., Fenchurch Street, London, E.C., from the judgment of Mr. Justice Branson in its action against Dorman, Long and Co., Ltd., of Zetland Road, Middlebrough, claiming limitation of liability for damage to a copper-dam at the Victoria Docks, London, caused by its being hit by a barge.

THE FORMATION IS ANNOUNCED of the Boron Agricultural Bureau, as a central organisation for the provision of information relating to the uses of borax in agriculture. The free services of the bureau are at the disposal of scientific institutions, farmers, and those engaged in the fertiliser industry. The bureau has its offices at Abford House, Wilton Road, London, S.W.1. (Tel. No. Victoria 5580) and is under the direction of Dr. A. W. Greenhill, late of the I.C.I. Agricultural Research Station at Jealott's Hill.

SPEAKING AT THE DINNER of the Institution of Mining and Metallurgy in London, Sir Henry Birchenough, president of the British South Africa Co., said members had every reason to be proud of what their Institution had done in the technical, educational, and scientific aspects of mining. During the forty-four years of its existence, the Institution had, among other things, been mainly responsible for the organisation of the Chamber of Mines and the Institute of Mining Technology. He believed that the real progress of an industry, or, indeed, a science, depended upon the co-operative work of a large number of people, and therefore he thought that the work which was being done by the Institution in the distribution of knowledge was of immense value.

ALTERATIONS IN THE CHARACTER of our export trade since the war were analysed briefly by Captain Euan Wallace, Secretary of the Department of Overseas Trade, at the annual luncheon of the Association of British Chambers of Commerce. Apart from social changes the economic policy of many countries which used to rely upon the United Kingdom for manufactured goods has involved the establishment of local industries capable of at least the simpler processes of manufacture. In the cotton industry the past few years have shown a shift from unbleached and white cloth to printed and dyed materials. In spite of a lower average of prices the export trade in worsted and woollen goods showed distinct advance last year and reached the highest figure since 1930. In the iron and steel group there has been a striking increase in the quantities and value of the newer ferro-alloys. Another industry which has shown encouraging signs of development is that of non-ferrous metals and manufactures. Our exports consist of more or less manufactured forms, such as sheets, wires, tubes, etc. In 1935 they reached £14,000,000, which was more than double the value of exports in 1932. The chemical industry (including drugs) has also contributed its quota to the improved export position. While the decrease during the depression years was less than the general percentage decrease in the export of manufactured goods, there has been a steady rise during the following years, so that exports are about £1,000,000 higher than in 1932. Last week Captain Wallace visited the Shirley Institute at Manchester. All that he saw in that remarkable institution confirmed his belief in the vital importance of research.

SODIUM LIGHTING is to be installed along the Purley Way, Croydon.

THE BOARD OF TRADE has issued an extensive list of chemicals, drugs, oils and paints which are affected by the new customs regulations and tariff changes under the 1936 Budget in Canada.

THE STAFF AND WORKERS at Ardeer factory and Nobel House (formerly the technical department), including the research division, subscribed £317 to charities for the March quarter.

A CYANIDE OF POTASSIUM BATH exploded at the Hoffman Manufacturing Co.'s works at Chelmsford on Thursday, resulting in the death of C. E. Rawlingson, aged 23, of Upper Bridge Road, Chelmsford.

A GRANT OF £500 PER ANNUM for five years has been made to the economics research section of the Faculty of Commerce and Administration at Manchester University by the trustees of the Cotton Trade War Memorial Fund for the continuance of research into matters connected with the cotton industry.

THE ANNUAL CANADIAN CHEMICAL CONVENTION will be held at the Brock Hotel, Niagara Falls, Ontario, from June 9 to 11. British chemists who are likely to be in Canada at that time are advised to communicate with Dr. R. T. Elworthy, secretary of the Canadian Institute of Chemistry, 366 Adelaide Street West, Toronto, 2, Canada.

The Chemical Age Lawn Tennis Tournament

ENTRIES CLOSE NEXT MONDAY

NEXT Monday, May 11, is the last date for receiving entries for the sixth annual CHEMICAL AGE Lawn Tennis Tournament. All entry forms should be forwarded at once to the Editor, THE CHEMICAL AGE, Bouverie House, 154 Fleet Street, London, E.C.4. Lawn tennis players engaged in any capacity in the chemical profession or industry in Great Britain are eligible for free entry for the tournament, full particulars of which have been published in previous issues. This year for the first time it is possible for partners in the doubles to be members of separate firms.

For the convenience of any who cannot now procure entry forms in time, we shall be prepared to accept entries written on ordinary paper, provided the following information is given: Name, name and address of firm, telephone number and a clear indication as to whether it is desired to enter the singles and/or the doubles.

EXTENSIONS OF VARIOUS DEPARTMENTS in the schools under the jurisdiction of the governors of Robert Gordon's Colleges, Aberdeen, are contemplated. In chemistry and pharmacy the requirements include the enlargement of the laboratory for metallurgy and fuels from its present capacity for six students to accommodation for twenty students; extended accommodation for evening classes in chemistry; additional chemistry balance room, and an additional laboratory for teaching biology and pharmacognosy.

ANOTHER LARGE COKING AND BY-PRODUCT SCHEME in the South Yorkshire coalfield is being pushed forward in order to take advantage of the present boom in coke impelled by the industrial activity of the Midlands. This plant is being erected at Blacker, near Wombwell, by the Woodall-Duckham Co. for the Barnsley and District Coking Co., and in order to provide for a big output of coke, supplies of coke-oven slack will be drawn from three collieries—Wombwell Main, Barnsley Main and Barrow. The works are being erected on a fifteen-acre site. It is hoped to bring the plant to the producing stage in about two months' time. The ovens will be heated by gas produced in them. Surplus gas will be piped to industrial consumers at Barnsley, four miles away, and a 12-in. gas main is being laid under the towing path of the Sheffield and South Yorkshire Navigation Co.'s canal.

TWO MEN WERE FATALLY INJURED in an explosion on May 4, at the Ardeer Factory, Stevenston, Ayrshire, belonging to Imperial Chemical Industries, Ltd. They were John Rowan (39), Gladstone Road, Saltcoats; and James Montgomerie (42), Ardeer Square, Stevenston. The men were working in one of the brick and wood buildings which are constructed on the sand dunes along the Ayrshire coast, and are used for the manufacture and experimentation of high explosive. It is not quite definitely ascertained how the accident occurred, but it is believed that some nitrol cotton was ignited, and before the two men who were working in the building could get clear, the whole place was a mass of flames. The last serious accident at Ardeer factory occurred in January of last year when one man was killed and three died after an explosion in an experimental building.

PRESIDING AT THE ANNUAL MEETING of the New Transvaal Chemical Co., Ltd., on Wednesday, Baron Emile B. D'Erlanger said that the offers to the preference shareholders to exchange their shares for shares—to be converted into stock—of Lever Brothers, would remain open until May 23. All the directors had accepted the offers in respect of their shares, and, in addition, a large proportion of the investment companies who held shares in the company had also accepted.

ELEVEN QUARRY WORKERS engaged in drilling a heading at a limestone quarry, belonging to Hadfields, at Caldon Low, near Leek, Staffordshire, fled for their lives on Wednesday when an explosion occurred, followed by a fall of stone estimated to weigh at least ten thousand tons. Five of the men were trapped by the fall and injured. Roland Jones (50), of Caldon Low, died from his injuries. Clouds of dust hampered rescue operations for a time, and it was not known how many men were buried.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Australia.—The British Trade Commissioner at Melbourne reports that the Victoria State Rivers and Water Supply Commission is calling for tenders, to be presented in Melbourne by June 24, for the supply of a motor-driven centrifugal pumping unit, starting gear, switchboard and necessary cables and connections. (Ref. No. TY 30122.)

Canada.—A firm of manufacturers' agents recently established at Vancouver wishes to obtain the representation for Western Canada, on a commission basis, of United Kingdom manufacturers of druggists' sundry lines. (Ref. No. 343.)

Egypt.—The Commercial Secretary to the Residency, Egypt, reports that the Egyptian Ministry of Public Works is inviting tenders, to be presented in Cairo by May 27, 1936, for the supply of 1,000 kilos. of red varnish floating, 500 kilos of bituminous black paints, 80 paint brushes, and 160 varnish brushes. Further particulars of this call for tenders can be obtained upon application to the Department of Overseas Trade. (Ref. No. 27872/36.)

Argentina.—An agent established at Buenos Aires wishes to obtain the representation, on a commission basis of United Kingdom exporters of magnesium oxide for glazing, black nickel oxide for glazing; cordozon arabic gum; coconut oil (with 1 per cent. acidity and 2 per mil. denaturalisation with citronella). (Ref. No. 363).

Chemical and Allied Stocks and Shares

CONTINUED uncertainties attaching to the European political situation and the weakness of Wall Street markets have led to a falling off of business in the industrial section of the stock exchange and as a result price movements have been against holders. Imperial Chemical and other leading shares of chemical and allied companies were relatively steady. Salt Union show little change on balance for the week and B. Laporte continued to be held firmly on the belief that the report will show a further good increase in profits and the maintenance of the dividend at 20 per cent. Steveley Coal and Iron were well maintained on balance, hopes of a possible increase in dividend having persisted in the market. Stewarts and Lloyds were depressed on the decrease in trading profits disclosed by the report, although the dividend is maintained at 5 per cent. and actual earnings on the deferred shares prove to be nearly 10 per cent. The lower profits are attributed in the market to the break up of the International Tube Cartel which has resulted in increased competition in export markets. In the current year the market expects that fuller benefits are likely to accrue from the large Corby works. No doubt the chairman's usual lengthy review at the meeting will provide information as to the main points in the position and outlook.

Boots Pure Drug were less active as opinion in the market is now divided as to whether there will be a share bonus or an increase in the usual cash bonus which is paid in addition to the dividend. Reckitt and Sons ordinary shares were very firm, having continued under the influence of the statements at the recent meeting. International Nickel failed to benefit to any extent from the increase in the quarterly dividend, as in common with most internationally-dealt-in shares they were dominated by the set-back in Wall Street markets. United Molasses have reacted, although there are still confident expectations current that a progress report can be expected before long and possibly an interim dividend as well. British Glues were again good on dividend hopes and the preference very firm on prospects of them benefiting from their participating dividend rights. Distillers were steady on continued talk of a larger distribution and a possible bonus. Goodlass Wall and Lead Industries have remained at the rather lower price to which they went recently. No doubt the decision not to increase the dividend is due in the main to the fact that the company has business interests and important connections abroad and overseas. The full results show that over 7½ per cent. has been earned on the ordinary shares. United Glass Bottle ordinary held up quite well. For years the company has distributed its profits on a conservative basis and as it is believed great attention has been given to the maintenance of plant in a thoroughly up-to-date condition, it is possible future profits may be distributed on a rather more liberal basis. Fison, Packard were again steady on hopes of a larger interim dividend and Unilever show little change. British Match were not quotably effected to any extent by the dividend of 6 per cent., which is the same as that paid for the previous year. Valor shares were firmer following the reaction which took place after the directors' statement as to the inaccurate rumours that had been current in some quarters of the market. Oil shares were steadier, the larger interim dividend of Trinidad Leaseholds having increased the belief that the impending dividends of Shell Transport, Anglo-Iranian and Burmah Oil will also be at a higher level than the corresponding payments of a year ago.

New Companies Registered

Anglo-Continental Pulp and Paper Co., Ltd., Sentinel House, Southampton Row, London, W.C.1.—Registered April 29. Nominal capital £5,000. Manufacturers of, agents for and dealers in chemical wood pulp, straw-pulp, paper-pulp, half stuff, bleaching materials, colouring matters and other materials and substances used in the manufacture of paper, artificial silk, staple fibre or other textile, chemical or organic material, etc. Directors: Dr. Charles Hartig, Felix Bachrach.

Fermene Products, Ltd.—Registered May 4. Nominal capital £100. Producers and manufacturers of or cultivators, blenders and refiners of salts, acids, alkalis, drugs, medicines, etc. A subscriber: Bernard C. Spicer, 89 Dollis Hill Avenue, N.W.2.

Lewis Berger (Scotland), Ltd.—Registered May 1 in Edinburgh. Nominal capital £5,000. Oil and colour merchants and manufacturers, importers, exporters and manufacturers of and dealers in oils, paints, pigments, varnishes, insecticides, etc. A subscriber: Charles Braidwood, 36 Castle Street, Edinburgh.

Prices of Chemical Products

WITH the exception of the items mentioned below the prices of British chemical products remain unchanged from last week (pages 410-411). The demand for chemicals in the London market continues to be of a satisfactory volume.

MANCHESTER.—The Manchester market for chemical products during the past week has been comparatively featureless and not a great deal of buying activity has been in evidence. There has been a sprinkling of contract renewals, but in most instances commitments extend further ahead and the question of replacement orders does not therefore arise as yet. There has been also a moderate volume of buying for prompt delivery, although the aggregate business covered by these has not been important. In the meantime, there has been no marked setback in the rate at which chemicals are being taken into consumption locally and sellers report a continued flow of specifications, particularly for the bread-and-butter lines. Prices keep steady for most descriptions of chemicals, including the tar products, the outstanding exceptions in the case of the latter being pitch and crude tar, values of which are on a lower level.

SCOTLAND.—There has been an improved demand for chemicals for home trade during the week, and also rather more inquiry for export. Prices generally remain very steady at about previous figures with only slight changes to report.

General Chemicals

CADIUM SULPHIDE.—5s. 1d. to 5s. 4d. per lb.

LAMPBLACK.—£40 to £43 per ton.

POTASH CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £38.

SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 2s. 6d. to £3 5s.

SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 7s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid, 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial £8.

Coal Tar Products

ACID, CARBOLIC.—Crystals, 6¾d. to 7¼d. per lb.; crude, 60's, 2s. 3d. to 2s. 6d. per gal. MANCHESTER: Crystals, 7d. per lb.; crude, 2s. 2d. per gal. SCOTLAND: 60's, 2s. 6d. to 2s. 7d.

PITCH.—Medium, soft, 37s. 6d. per ton, in bulk at makers works. MANCHESTER: 30s. to 32s. 6d. f.o.b., East Coast.

Inventions in the Chemical Industry

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

PROTEOLYTIC ENZYMES, treatment of materials containing or securing.—Aktieselskabet Dansk Goerings Industri. Oct. 26, 1934. 20792/35.

HIGH MOLECULAR 1.2 GLYCOLS, a process for the production.—Böhme Fettchemie-Ges. Oct. 27, 1934. 25383/35

CELLULOSE ETHERS, preparation.—Rohm and Haas Co. Oct. 26, 1934. 25885/35.

PITUITARY HORMONES, process for the manufacture of stable injectable preparations.—F. Hoffmann-La Roche and Co. Akt-Ges. Oct. 27, 1934. 26953/35.

POLYESTER COMPOUNDS and methods of making.—Standard Oil Development Co. Oct. 25, 1934. 27234/35.

DRYING AGENTS, manufacture.—H. Naamlooze Vennootschap Industrieele Maatschoppij Vorm, Noury and Van Der Lande. Oct. 27, 1934. 27792/35.

ESTERS, preparation.—Carbide and Carbon Chemicals Corporation. Oct. 26, 1934. 28791/35.

REFINING METALS, process.—Scovill Manufacturing Co. Oct. 26, 1934. 28914/35.

TRANSPARENT CELLULOSE FORMATE PRODUCTS.—R. Koepp and Co. Chemische Fabrik Akt.-Ges. Oct. 22, 1934. 29149/35.

HYDROGENATION OF COAL and other carbonaceous compounds, process of and apparatus.—Compagnie de Bethune. Oct. 22, 1934. 29176/35.

APPARATUS FOR PRODUCING PRESSURE in containers for liquids by means of solid carbon dioxide.—I. G. Farbenindustrie. Oct. 27, 1934. 29246/35.

INSECTICIDAL COMPOSITIONS.—Grasselli Chemical Co. Oct. 24, 1934. 29317/35.

RUBBER COMPOSITIONS.—I. G. Farbenindustrie. Oct. 24, 1934. 29409/35.

METAL ALKYL COMPOUNDS, manufacture.—E. I. du Pont de Nemours and Co. Oct. 27, 1934. 29630/35.

ORGANIC ESTERS OF SELLULOSE, method of making.—British Celanese, Ltd. Oct. 26, 1934. 29681/35.

DYES FOR USE IN PHOTOGRAPHIC SILVER HALIDE EMULSIONS, manufacture.—Gevaert Photo Producten Naamlooze Vennootschap. Oct. 27, 1934. 29702/35.

Specifications Accepted with Date of Application

REFINING MAGNESIUM, method of and apparatus.—Magnesium Products, Inc. July 11, 1933. 445,849.

FORM-STABLE THERMOPLASTIC COMPOSITIONS and articles made therefrom. H. E. Potts (Shawinigan Chemicals, Ltd.). Aug. 18, 1934. 445,856.

NITRO-DERIVATIVES of 1-sulpho-2-hydroxynaphthalene-3-carboxylic acid. W. W. Groves (I. G. Farbenindustrie). Oct. 8, 1934. 445,857.

AZO DYESTUFFS, manufacture and production.—Coutts and Co., and F. Johnson (legal representative of J. Y. Johnson). Oct. 15, 1934. 445,862.

BERYLLIUM ALLOYS, production.—Heraeus Vacuumschmelze Akt.-Ges., and Dr. W. Rohn. Oct. 19. 445,888.

DYESTUFFS OF THE ANTHRACENE SERIES, process for the manufacture.—I. G. Farbenindustrie. Oct. 19, 1933. 445,892.

CONDENSATION PRODUCTS, process for the manufacture.—I. G. Farbenindustrie. Oct. 21, 1933. 446,173.

PERYLENE, manufacture.—W. W. Groves. Nov. 2, 1933. 445,896.

SEPARATION OF THE SOLID SUBSTANCES in products and residues of the destructive hydrogenation of distillable carbonaceous materials.—H. E. Potts (International Hydrogenation Patents Co., Ltd.). Oct. 22, 1934. 445,898.

REDUCTION OF HYDROCARBONS.—E. I. du Pont de Nemours and Co. Oct. 20, 1933. 446,013.

CHLORINATED RUBBER, manufacture.—W. D. Spencer, S. Steele, and Imperial Chemical Industries, Ltd. Oct. 23, 1934. 446,103.

HEAT TREATMENT OF CARBONACEOUS MATERIALS with hydrogenating gases.—H. E. Potts (International Hydrogenation Patents Co., Ltd.). Dec. 11, 1934. (Cognate Application, 2037/35.) 446,114.

CONVERTING ALCOHOLS INTO ETHERS, process.—Crima Soc. Anon. Dec. 20, 1933. 445,963.

ALIPHATIC ORGANIC COMPOUNDS, production.—Carbide and Carbon Chemicals Corporation. Jan. 5, 1934. 446,026.

COAL GAS, manufacture.—Woodall-Duckham (1920), Ltd., and F. S. Townend. Feb. 25, 1935. 446,035.

HALOGENATED ETHERS, manufacture and production.—G. W. Johnson (I. G. Farbenindustrie). April 9, 1935. 446,222.

HALOGENATED ETHERS, manufacture and production of.—G. W. Johnson (I. G. Farbenindustrie). April 9, 1935. 446,041.

MOULDED BODIES FROM MOULDING POWDER such as artificial resin, manufacture.—Soc. of Chemical Industry in Basle. June 8, 1934. 446,046.

PURIFICATION OF SEWAGE or gases containing air or oxygen.—H. Blunk. Dec. 24, 1934. 446,066.

AZO DYESTUFFS, manufacture.—J. R. Geigy Akt.-Ges. Nov. 10, 1934. 445,999.

OXYGENATED ALIPHATIC COMPOUNDS derived from 2-ethylbutyraldehyde, preparation.—Carbide and Carbon Chemicals Corporation. Dec. 18, 1934. 446,084.

Applications for Patents

(April 23 to 29 inclusive.)

SOFTENING AGENTS FOR PLASTIC MASSES.—G. W. Johnson (I. G. Farbenindustrie). 11367.

PREPARATION OF (1-phenyl-2, 3-dimethyl-5-pyrazolonyl)-isopentylketone.—H. P. Kaufmann. (Germany, May 7, '35.) 11103.

HYDROCYANIC GAS, generation.—B. W. Malishev. 11210.

CARBAMIDE AND FORMALDEHYDE PRODUCTS, manufacture.—P. Michaut. (France, June 8, '35.) 11526.

UREA AND FORMALDEHYDE VARNISHES, ETC., manufacture.—P. Michaut. (France, Sept. 25, '35.) 11527.

SULPHURIC ACID, manufacture.—W. Schefczik. (Germany, Apr. 20, '35.) 11188.

CARBAMIDE AND FORMALDEHYDE products, manufacture.—L. Segond. (France, June 8, '35.) 11526.

APPARATUS FOR GENERATING OXYGEN.—W. H. A. Thiemann (I. G. Farbenindustrie). 10999.

EXTRACTION OF POTASH SALTS from blast furnace flue dusts, process.—G. F. Thomson. 11355.

PHOSPHATES, method of making.—Akt.-Ges. der Chemischen Produkten Fabrieken Pommerensdorf-Milch, J. H. Werntz and E. I. du Pont de Nemours and Co. (Germany, April 26, '35.) 12005.

PHOSPHATES, method of making.—Akt.-Ges. der Chemischen Produkten Fabrieken Pommerensdorf-Milch. (Germany, Feb. 24.) 12006.

ORGANIC COMPOUNDS containing sulphur.—P. R. Austin. 12207.

CYANINE DYES, manufacture.—B. Beilenson and Kodak, Ltd. 11664.

CADMIUM, process for extraction.—Berzelius Metallhütten Ges. (Germany, April 25, '35.) 11594.

SULPHONIC ACID AMIDE COMPOUNDS, manufacture.—A. Carpmael (I. G. Farbenindustrie). 12100.

CONDENSATION PRODUCTS of anthraquinone series, manufacture. A. Carpmael (I. G. Farbenindustrie). 12101.

CARBONATES AND HYDROXIDES, manufacture.—Consolidirte Alkaliwerke. (Germany, April 27, '35.) 11979. (Germany, May 2, '35.) 11980. (Germany, May 6, '35.) 11981. (Germany, May 31, '35.) 11982. (Germany, March 9.) 11983.

ALKALINE SALTS, manufacture.—A. E. A. S. Cornelius. (Norway, May 1, '35.) 12039.

ALKALINE SALTS, manufacture.—A. E. A. S. Cornelius. (Norway, July 3, '35.) 12040. (Cognate with 12039.)

Forthcoming Events

LONDON

May 6—Society of Public Analysts. "The Effect of some Impurities in Anaesthetic Ether: Peroxides," J. H. Coste and D. C. Garratt; "The Determination of Bromides in Presence of other Halides," F. W. Edwards, H. R. Nanji and E. B. Parkes; "A New Photographic Filter Cell," C. Ainsworth Mitchell and T. J. Ward; "A Micro-Zeisel Apparatus for Determining Methoxyl and Ethoxyl Groups," J. J. Chinoy. 8 p.m. Burlington House, Piccadilly, London.

May 11.—University of London. "Researches on the Specific Heats of Metals and their Alloys at High Temperatures." Professor Dr. F. M. Jaeger. 5.30 p.m. University College, Gower Street, London.

May 12, 13 and 14.—University of London. "Cardiac Glucosides." Professor Dr. Arthur Stoll. 5.30 p.m. College of the Pharmaceutical Society, 17 Bloomsbury Square, London.

May 13.—Electrodepositors' Technical Society. Spring meeting. Annual election. Fourth William James Memorial Lecture by D. J. MacNaughtan. 8.15 p.m. Northampton Polytechnic Institute, St. John Street, Clerkenwell, London.

May 14.—The Chemical Society. "Modern Chemical Nomenclature." Dr. Clarence Smith. 8 p.m. Institution of Mechanical Engineers, Storey's Gate, London.

STOKE-ON-TRENT

May 11.—The Ceramic Society (Pottery Section). Discussion on "The Utilisation of Casting Scraps." 7.30 p.m. North Staffs. Technical College, Stoke-on-Trent.

Company News

Mannesmann Tube Works.—Dividends are to be resumed with a payment of 3 per cent. for 1935. Net profits increased from Rm.2,400,000 to Rm.5,330,000.

Crosfields Oil and Cake Co.—The first and final dividend is announced of 15 per cent., less tax, for the year to March 31, 1936, the same as last year, payable on May 22.

International Nickel Co. of Canada.—A quarterly dividend of 30c. per share has been declared. In the past two quarters the company was paid 25c. per share. Last year dividends totalled 75c.

United Drug, Inc.—The net income for 1935 was $1,504,518 (against $1,833,960), including extraordinary income of $605,161 and extraordinary deductions of $455,338.

Reckitt and Sons, Ltd.—A quarterly dividend of 1s. per ordinary share (5 per cent.) is announced, payable on July 1 next to holders registered on June 6. This is the same payment as at this time last year. The usual payments on the 4½ per cent. and 5 per cent. preference shares and the 4 per cent. debenture stock are also announced.

W. G. Frith and Co.—A net revenue balance of £10,995 is announced after depreciation and fees, in respect of the sixteen months to February 29 last. After tax provision totalling £2,082, directors recommend a dividend at the rate of 6¼ per cent., less tax, absorbing £5,004, the allocation of £1,027 to write off the balance of preliminary expenses, and £1,675 off goodwill. The amount to go forward is £1,207.

Goodlass Wall and Lead Industries, Ltd.—The directors in their report state that the accounts for 1935 show that profits rose from £239,317 to £249,006. Out of this amount it is proposed to take £50,000 to start a general reserve fund. A further £5,000 is placed to staff fund, and after paying the usual 7 per cent. preference and preferred dividends and maintaining the year's ordinary dividend at 6 per cent., a surplus of £74,484 is carried forward, against £97,629 brought in.

British Match Corporation.—A further substantial increase is reported in earnings over the year to April 30 last. Total revenue is up from £471,423 to £483,376, and the net balance at £463,942 compares with £451,590 a year ago, and is the highest level attained since 1929-30. Preference dividends absorb £22,859, and the ordinary payment of 7⅞ per cent., less tax (against 6 per cent., tax free), takes £378,743. Goodwill valuation is again written down by £60,000, to £440,000, the total of sums written off to date being £360,000.

Compañía Salitrera de Tarapaca y Antofagasta (Tarapaca and Antofagasta Nitrate Co.), successor to Cosach.—For the first twelve months of the company, to June 30, 1935, the report shows that the net profit, after directors' fees, was $14,988,580 in Chilean currency. Statutory reserve receives $749,429, contingency reserve $1,498,858, and $749,429 is applied to a reserve for extraordinary amortisation or other purposes, leaving $11,990,864, of which $9,592,691 is applied in amortisation of the preferred bonds and $2,398,172 for the redemption of other bonds. The sum of U.S. $1.50 per ton of nitrate produced during the year has been added to working account. In view of this circumstance no direct provision has been made for the depletion of nitrate grounds nor for depreciation of other capital assets, but, as shown above, $749,429 is applied to a reserve for extraordinary amortisation and other purposes. The directors report that as a result of the favourable trading during the year, the company was able to commence the redemption of the bonds issued in respect of certain obligations with which the company was burdened.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt as specified in the last available Annual Summary, is also given marked with an *—followed by the date of the Summary, but such total may have been reduced.)

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County Court Judgments

(NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court Judgments against him.)

STEWART, R. A. (male), 163 Fenchurch Street, E.C., chemical merchant. (C.C., 9/5/36.) £24 16s. 0d. February 20.

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